Manitoba Ambient Air Quality Annual Report for 2000, 2001 and 2002

By B.P. Krawchuk
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Protecting & Managing our Future

Manitoba Conservation

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Manitoba Ambient Air Quality

Annual Reports for 2000, 2001 and 2002

B. P. Krawchuk
Air Quality Section
Programs Division

Manitoba
Conservation

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Includes at least 10% post-consumer waste

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ABSTRACT

As part of an on-going environmental quality monitoring program, Manitoba Conservation monitored the quality of ambient air at several urban locations during 2000, 2001 and 2002. This monitoring consisted of the use of established monitoring sites having dedicated instrumentation primarily for continuous air sampling and analysis. This report covers data from the above activities of Manitoba Conservation and selected other ambient monitoring performed by companies under Manitoba Environment Act requirements.

The ambient air quality program is structured to determine air quality in two areas: general urban air quality and air quality in the vicinity of some selected industries.

The general urban air quality program consisted primarily of sampling activities within the Federal/Provincial National Air Pollution Surveillance (NAPS) program. Sampling at NAPS sites consisted of measurement of the following air pollutants: carbon monoxide, nitrogen dioxide, nitric oxide, nitrogen oxides, ground level ozone, total suspended particulate matter, inhalable particulate, volatile organic compounds, polyaromatic hydrocarbons, aldehydes and ketones, lead, sulphates and nitrates. Of these contaminants, total suspended particulate matter most often exceeded the 24-hour provincial standard. Based on the Canadian Annual Index of Air Quality, the air quality at the downtown and residential stations in Winnipeg was rated "Good" (the best rating) most of the time (>90%).

The monitoring of air quality in the vicinity of specific industries having (or potentially having) atmospheric emissions was restricted to the areas around the Northern smelters (at Flin Flon and Thompson) and an industrial park in Brandon. Monitoring was specifically for the pollutant(s) of industrial emission. Data from Flin Flon showed a continuing presence within the community of elevated sulphur dioxide levels with excursions above air quality objectives. Some ammonia levels above air quality objectives were observed in the Brandon industrial park area.

Krawchuk, B.P., 2005. *Rapport sur la qualité de l'air ambiant au Manitoba pour 2000, 2001 et 2002.* Ministère de la Conservation du Manitoba, Section de la qualité de l'air. Rapport n° 2005 01, xvi + 89

RÉSUMÉ

Dans le cadre d'un programme permanent de surveillance de la qualité de l'environnement, le ministère de la Conservation du Manitoba a suivi de près la qualité de l'air ambiant dans plusieurs secteurs urbains durant les années 2000, 2001 et 2002. Ce suivi a été effectué par l'intermédiaire de prélèvements d'air en continu à des fins d'analyse dans plusieurs stations de surveillance pourvues d'instruments de mesure entièrement destinés à cette tâche. Ce rapport fait le bilan des données recueillies dans le cadre du programme mené par le ministère de la Conservation du Manitoba et incorpore également des résultats du même genre recueillis par des entreprises privées, en vertu de la *Loi sur l'environnement*.

Le programme de surveillance de la qualité de l'air a deux grands axes : déterminer la qualité globale de l'air en région urbaine ainsi que celle observée à proximité de certaines industries bien particulières.

Le programme de surveillance de la qualité générale de l'air en région urbaine relève du Réseau national de surveillance de la pollution atmosphérique (RNSPA) mis en œuvre par les gouvernements fédéral et provincial. Il consistait principalement à prélever des échantillons d'air pour y mesurer les quantités de polluants suivants : le monoxyde de carbone, le dioxyde d'azote, le monoxyde d'azote, les autres oxydes d'azote, l'ozone au niveau du sol, les hydrocarbures aromatiques polycycliques, les composés organiques volatils, l'aldéhyde et la cétone, le plomb, les sulfates et les nitrates. Il a permis également d'évaluer la quantité totale de particules en suspension dans l'air et la quantité de particules pouvant être inhalées. Les échantillons prélevés ont révélé que la quantité totale de particules en suspension excédait le plus souvent la norme provinciale établie pour une exposition de 24 heures. Selon l'indice annuel canadien, la qualité de l'air aux stations du centre-ville et à celles des secteurs résidentiels de Winnipeg a été qualifiée de « bonne » (meilleure cote de l'indice) dans la grande majorité des cas (+ de 90 %).

La qualité de l'air à proximité d'industries qui émettent ou pourraient émettre des déchets atmosphériques n'a été évaluée que dans les régions proches des fonderies du Nord (à Flin Flon et à Thompson) ainsi qu'à proximité d'un parc industriel de Brandon. Les analyses étaient plus particulièrement orientées vers la détection des émissions industrielles. Les relevés faits à Flin Flon ont montré une présence continue et élevée d'anhydride sulfureux dans l'air ambiant de cette communauté, qui dépassait fréquemment le seuil fixé par la province. Certains taux trop élevés d'ammoniac ont également été enregistrés dans la région du parc industriel de Brandon.

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As	Arsenic
Cd	Cadmium
CO	Carbon Monoxide
COH	Coefficient of Haze
Cu	Copper
D.L.	Detection Limit
IQUA	Index of the Quality of Air
MAL	Maximum Acceptable Level
MDL	Maximum Desirable Level
MTL	Maximum Tolerable Level
N/A	Not Available
NAPS	National Air Pollution Surveillance (air quality monitoring network)
N.D.	Not Detected
NH_3	Ammonia
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
NO_3^-	Nitrates
O_3	Ozone (ground level)
PAH	Polycyclic Aromatic Hydrocarbons
Pb	Lead
PCDD/PCDF	PolyChlorinated Dibenzo-*p*-Dioxins/PolyChlorinated Dibenzo-*p*-Furans
$PM_{2.5}$	Inhalable Particulate (particulate matter 2.5 µm or less in diameter)
PM_{10}	Inhalable Particulate (particulate matter 10 µm or less in diameter)
$24PM_{2.5}$	Inhalable particulate measured continuously over a 24 hour period
$24PM_{10}$	Inhalable particulate measured continuously over a 24 hour period
pg/m^3	Picograms (10^{-12} g) per cubic metre
pphm	parts per hundred million (by volume)
ppm	parts per million (by volume)
SO_2	Sulphur Dioxide
$SO_4^=$	Sulphates
TSP	Total Suspended Particulate matter
$\mu g/m^3$	micrograms (10^{-6} g) per cubic metre
µm	micrometre ($1x10^{-6}$ metre)
VOC	Volatile Organic Compounds
Zn	Zinc
>	greater than
<	less than

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INTRODUCTION

The Province of Manitoba has monitored ambient air quality at several locations throughout Manitoba since 1968. During 2000, 2001 and 2002, monitoring activities by Manitoba Conservation and companies, under Environment Act requirements, took place in Winnipeg, Brandon, Thompson, and Flin Flon. This report presents a summary and a discussion of these data generated by the above monitoring activities during 2000, 2001 and 2002 (January 1 through December 31, respectively). During 2000 and 2001, additional special monitoring activities were undertaken in the Pierson, Waskada, Deloraine and Virden areas of Manitoba as a result of interest regarding the activities of the petroleum industry in the area (Manitoba Conservation, 2002a & b).

The majority of sampling is of a continuous nature involving dedicated monitors in permanent stations and can be divided into two basic categories: (1) General or Urban Air Quality monitoring; and (2) Source specific or Industrial monitoring. Much of the General or Urban Air Quality monitoring is performed under the auspices of the Federal-Provincial National Air Pollution Surveillance (NAPS) program, which provides a nationwide data base for determining air quality levels across Canada, and also documents trends arising as a result of changing industrial activity, fuel use, population density and use of pollution control strategies.

Source specific or Industrial monitoring is performed by the Impingement Program within the Air Quality Section as well as by the regulated companies. This monitoring contributes to the evaluation of ambient air quality in the vicinity of specific industries in order to determine compliance with Provincial Air Quality Guidelines and Objectives.

This report covers the 2000, 2001 and 2002 data for the following parameters: Carbon Monoxide (CO), Nitrogen Dioxide (NO_2), Nitric Oxide (NO), Nitrogen Oxides (NO_x), Ground Level Ozone (O_3), Ammonia (NH_3), Sulphur Dioxide (SO_2), Total Suspended Particulate (TSP), Inhalable Particulate (PM_{10}), Inhalable Particulate ($PM_{2.5}$), Lead (Pb), Sulphates ($SO_4^=$), Nitrates (NO_3^-), Arsenic (As), Cadmium (Cd), Copper (Cu), Zinc (Zn), Volatile Organic Compounds (VOCs), PolycyclicAromatic

Hydrocarbons (PAHs), Polychlorinated Dibenzo-*p*-Dioxins/Furans (PCDDs/PCDFs) and Aldehydes and Ketones.

The purpose of this report is to:

1) outline ambient air monitoring activities in the Province during 2000, 2001 and 2002;

2) provide summary statistics and a comparison to air quality objectives and/or guidelines (where applicable);

3) compare 2000, 2001 and 2002 data with previous years; and

4) provide a rating of the air quality relative to the Canadian Annual Index of Air Quality for major monitoring sites.

BACKGROUND

A) Manitoba Air Quality Objectives and Guidelines

The Province of Manitoba has adopted the National Ambient Air Quality objectives for those pollutants for which such objectives have been promulgated (sulphur dioxide, suspended particulate matter, carbon monoxide, ozone, and nitrogen dioxide). Air Quality Guidelines have been developed and adopted by the Province for other specific pollutants (Manitoba Conservation 2002).

The guidelines have three levels: the maximum tolerable level (MTL), the maximum acceptable level (MAL) and the maximum desirable level (MDL).

In the majority of cases, urban air quality is expected to meet the MAL, whereas, in rural areas, it is the long term goal to ensure that the MDL's are not exceeded.

A list of "Ambient Air Criteria" currently endorsed by Manitoba Conservation can be found in the previous report (Krawchuk, 2002) as well as on the Internet at the following url: http://www.gov.mb.ca/conservation/airquality/aq-criteria/index.html

B) POLLUTANTS

Characterization of the air pollutants mentioned in this report is as follows:

Carbon Monoxide (CO) is a colourless, odourless and tasteless gas slightly lighter than air. It is considered a dangerous asphyxiant because it combines strongly with the hemoglobin of the blood and reduces the blood's ability to carry oxygen to cell tissues. CO is a product of incomplete combustion of carbon and is emitted by fossil fuel combustion sources (e.g. motor vehicles). CO is measured on a continuous basis by the technique of non-dispersive infrared spectrometry and the data are generally reported in the form of hourly averages from which further time-weighted averages can be determined.

Nitrogen Dioxide (NO_2) is a reddish-brown gas with a pungent, irritating odour. It originates chiefly from combustion sources as well as from conversion of nitric oxide. Nitrogen dioxide exerts its primary toxic effect on the lungs and can be associated with increased susceptibility to respiratory infections and abnormal dilation of the air spaces and distension of the lung's walls. Nitrogen dioxide also suppresses vegetation growth, causes corrosion of metals, reduces visibility, and acts as a precursor in the formation of ground level ozone by reacting with hydrocarbons. It is measured continuously by the technique of chemiluminescence with data reported as hourly averages.

Nitrogen dioxide is also recognized as a significant contributor to the formation of acid rain.

Nitric Oxide (NO) is a colourless, odourless and tasteless gas which in nature is produced by biological action but in polluted atmospheres is produced primarily by fuel combustion in both stationary and mobile sources. By itself nitric oxide is not usually considered a pollutant but, in a polluted atmosphere, it is readily oxidized to nitrogen dioxide through a photochemical secondary reaction. Nitric oxide is measured concurrently with nitrogen dioxide by the technique of chemiluminescence and the data are processed as hourly averages.

Ozone (O_3) is a pungent irritating gas formed naturally at high altitudes (i.e. in the stratosphere) by a photochemical reaction involving molecular and atomic oxygen. Ozone and other oxidants are formed in a polluted atmosphere at ground level as a result of a rather wide variety of photochemical reactions

involving nitrogen oxides and reactive hydrocarbons. In the stratosphere, ozone acts as a beneficial shield to screen unwanted ultraviolet radiation, whereas at ground level it is a pollutant. The overall effect of ozone is a stinging of the eyes and the mucous membranes. It is also responsible for an increase in asthma and other respiratory effects. Ozone reduces crop yields, injures vegetation and weakens materials such as rubber and certain fabrics, and is the major contributor to the formation of smog. Ground level ozone is measured by use of UV photometry and data are reported as hourly averages.

Ammonia (NH_3) is a colourless gaseous alkaline compound of nitrogen and hydrogen. It is lighter than air, has an extremely pungent smell and taste, is very soluble in water, and can be easily condensed by cold and pressure to a liquid state. Ammonia is an important industrial and agricultural compound used both as is and combined with other chemicals. Typical uses are as a fertilizer and as an explosive. Ammonia is not a major air pollutant but, on occasion, it can be a nuisance. It is measured continuously by the technique of chemiluminescence with data reported as hourly averages.

Sulphur Dioxide (SO_2) is a colourless gas with a pungent irritating odour. It is emitted primarily from the combustion of fossil fuels containing sulphur and from primary non-ferrous smelting. It is usually recognized as one of the major atmospheric pollutants. Sulphur dioxide causes an increased frequency of respiratory disease symptoms and lung disease. It also causes marked effects on vegetation, corrodes materials, and may oxidize in the atmosphere to form sulphuric acid and sulphates. Sulphur dioxide is the major contributor to the formation of acid rain. Sulphur dioxide is measured by use of the pulsed fluorescence technique with data reported as hourly averages.

Total Suspended Particulate (TSP) matter is a general term which applies to a large variety of inert solid or liquid particles of a size and configuration such that they remain suspended in the air and can be drawn into the respiratory passages. These types of particles, usually in the size range of 0.1 to 100 microns (μm), may originate as a result of industrial processes, human activities and from natural sources such as wind swept or entrained dust. By itself, or in association with other pollutants, TSP, in high enough concentration, may injure the respiratory system. TSP also may reduce visibility and contribute to property damage and soiling. A high volume air sampler is used to collect the particles on a Teflon or

glass fibre filter and results are reported as integrated 24-hour concentrations of mass of particulate matter per volume of air (volume-weighted).

Inhalable Particulate matter (PM_{10} and $PM_{2.5}$) is a fraction of the total suspended particulate found in the air. It is defined as the range of particles (solid and liquid) between 0.1 and 10 µm and 0.1 and 2.5 µm (respectively) in diameter that can penetrate into the tracheobronchial and alveolar regions of the lungs. A dichotomous sampler is used to collect the sample: a fine fraction less than 2.5 µm, and a coarse fraction between 2.5 and 10 µm. These two particulate sizes are combined to give the total for PM_{10} in a 24-hour period. A TEOM model 1400 PM_{10} monitor is also being used to give real time instantaneous readings at the Winnipeg downtown and residential stations, Flin Flon and Brandon. Results are reported as hourly averages and the running 24-hour average is used for calculations in determining the Air Quality Index. In Flin Flon a size-selective Hi-Volume air sampler was used to sample inhalable (PM_{10}) particulates on a six day cycle until the real-time TEOM instrument came on-line.

Lead (Pb) exists in the atmosphere primarily as a particulate resulting from certain source industries and from entrainment of dust previously affected by the combustion of leaded gasoline. Exposure to lead will adversely affect human health (especially young children) by absorption into the bloodstream and impairment of heme synthesis in cells. Other adverse effects associated with elevated blood lead levels include the possibility of nervous system damage. Lead is analyzed from a representative portion of the total suspended particulate collected by high volume sampling. Air concentrations are reported as integrated 24-hour concentrations of mass of lead per volume of air.

Other Heavy Metals: Copper (Cu), Cadmium (Cd), Zinc (Zn), and Arsenic (As) are constituents of TSP and are of interest in areas near point sources such as smelters. There are no Manitoba air quality Guidelines or Objectives for these substances. For evaluation purposes, Ontario's guidelines for these metals have been used where applicable.

Volatile Organic Compounds (VOCs) are a group of organic compounds in the alkaline, aromatic, alkyl halide and halogenated aromatic categories. Many of these are of concern due to their toxicity and role in photochemical oxidation. VOCs in combination with NO_x and sunlight produce ground level ozone, a

major component of urban smog. Sampling is conducted over a 24-hour period once every sixth day. Stainless steel canisters are used for collection and the samples are analyzed by Environment Canada.

Polycyclicaromatic Hydrocarbons (PAHs) are a group of organic compounds in the polycyclic aromatic category (2+ benzene rings fused together). Some of these are of concern due to their mutagenicity and carcinogenicity. Sampling was conducted over a 24-hour period once every twelve days. Teflon filters and Poly Urethane Foam (PUF) plug canisters are used for collection and the samples are analyzed by Environment Canada.

Polychlorinated Dibenzo-p-Dioxins (PCDDs) and Polychlorinated Dibenzo-p-Furans (PCDFs) are chemical compounds containing two benzene rings that are joined by two oxygen atoms in the case of dioxins and by one oxygen and a direct bond between the rings in the case of furans. Both molecules have eight positions which can be chlorinated. There are 75 possible chlorinated dibenzo-p-dioxin isomers ranging from 2 monochloro-species through 22 tetrachorospecies to 1 octachlorospecies. There are 135 possible chlorinated dibenzo-p-furan species. The chlorinated dibenzo-p-dioxins and furans are formed as a pyrolysis byproduct from chlorinated phenols. These compounds have been identified as part of the natural background in the environment. They have been identified as being part of the natural chemistry of fire, i.e., a natural wood fire will produce minute amounts of PCDDs and PCDFs. Of the dibenzo-p-dioxins the 2,3,7,8-tetrachlorodibenzo-p-dioxin isomer is the most toxic and is the one to which the toxicity of all the other isomers are compared to by means of a toxic equivalent factor (TEF). Of the 75 possible PCDDs only 7 have been identified as having a toxicity similar to 2,37,8-TCDD. Of the 135 possible PCDFs 10 have been identified with dioxin-like toxicity. These are the 17 compounds that are listed in Table 12. Sampling was conducted over a 24-hour period once every twenty-four days. Teflon filters and Poly Urethane Foam (PUF) plug canisters are used for collection and the samples are analyzed by Environment Canada.

Aldehydes and Ketones (carbonyls) are aliphatic (straight or branched chain) or aromatic (containing a benzene ring) hydrocarbons which also contain a carbonyl (C=O) group in either the end position (in the case of aldehydes) or non-end position (as in the case of ketones). These chemicals are used in a variety

of ways. They are solvents and intermediaries in the manufacture of other chemicals and substances. Certain of these compounds also find use as disinfectants, bactericides, fungicides and as flavouring and preserving agents. They are all flammable and have distinctive odours. In high vapour concentrations, many are irritants of the respiratory tract. Some of these compounds are also classified as mutagens and possible carcinogens. Sampling for these compounds was conducted over a 24-hour period every six days. A pre-coated cartridge was used to collect the sample and analysis was done by Environment Canada.

C) SAMPLING SITES

Figure 1 is a map of the urban areas included in the Manitoba Ambient Air Quality Monitoring Network. Figures 2 through 5 depict the monitoring locations within each of the urban centres.

Air monitoring stations are listed in more detail in Table 1 as to location, code number, pollutants monitored, and monitoring period during 2000, 2001 and 2002.

TABLE 1 **AMBIENT AIR MONITORING SITES (2000-2002)**

AREA	CODE	SAMPLING SITE LOCATION	SAMPLING PERIOD	POLLUTANTS MONITORED
Winnipeg (Downtown) NAPS Station	9119	65 Ellen Street	Jan. - Dec.	CO, NO_2, NO, NO_x, O_3, TSP, PM_{10}, VOCs, Pb, $SO_4^=$, NO_3^-, COH, PAHs, PCDD/PCDFs & Carbonyls
Winnipeg (Residential) NAPS Station	9118	299 Scotia Street	Jan. - Dec.	CO, NO_2, NO, NO_x, O_3, COH, TSP, PM_{10}, $PM_{2.5}$, Pb, $SO_4^=$, NO_3^-
Brandon (Downtown) NAPS Station	9201	1104 Princess Avenue	Jan. - Dec.	TSP, Pb, $SO_4^=$, NO_3^-
Brandon (Industrial)	5131	Assiniboine Community College (Lot)	Jan. - Dec.	NH_3, NO_2, NO, NO_x, O_3, PM_{10}
Flin Flon	7251	Provincial Building, 143 Main Street	Jan. - Dec.	SO_2, TSP, NO_3^-, $SO_4^=$, PM_{10}, Pb, As, Cd, Cu, Zn
	7271*	Aqua Centre	Jan. - Dec.	SO_2
	7281*	HBM&S Staffhouse	Jan. - Dec.	SO_2
	7284*	Ruth Betts	Jan. - Dec.	TSP, As, Cd, Cu, Pb, Zn PM_{10}, & $SO_4^=$
	7285*	Sewage Plant	Jan. - Dec.	TSP, As, Cd, Cu, Pb, Zn PM_{10}, & $SO_4^=$
	7286*	Creighton, Sask. - School	From June /97	TSP, As, Cd, Cu, Pb, Zn
	7291*	Creighton, Sask. Fire Hall	Jan. - Dec.	SO_2
	7301*	Hapnot Collegiate	Jan. - Dec.	SO_2
Thompson	7351*	Thompson Water Treatment Plant	Jan. - Dec.	SO_2
Special Study				
Virden	6114	East side of town	Jun. '00-Apr. '01	SO_2, H_2S
Pierson	6115	South side of town	Jun. '00-Feb. '01	SO_2, H_2S
Waskada	6116	Centre of town	Feb. '01-Apr. '01	SO_2, H_2S
Deloraine	6117	Northwest side of town	May '01-July '01	SO_2, H_2S

* denotes company supplied data

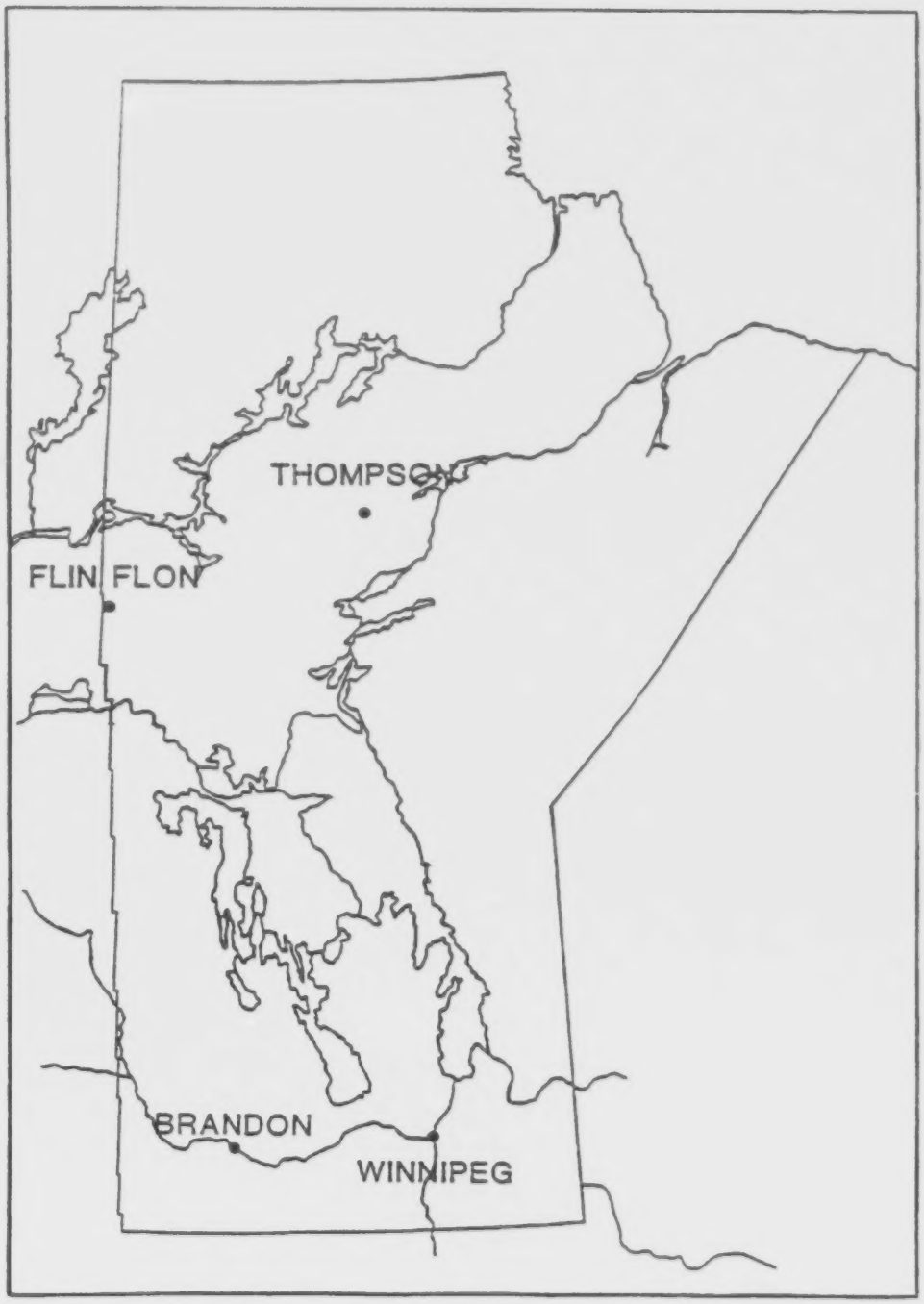

Figure 1. Urban Manitoba Ambient Air Quality Monitoring Network locations.

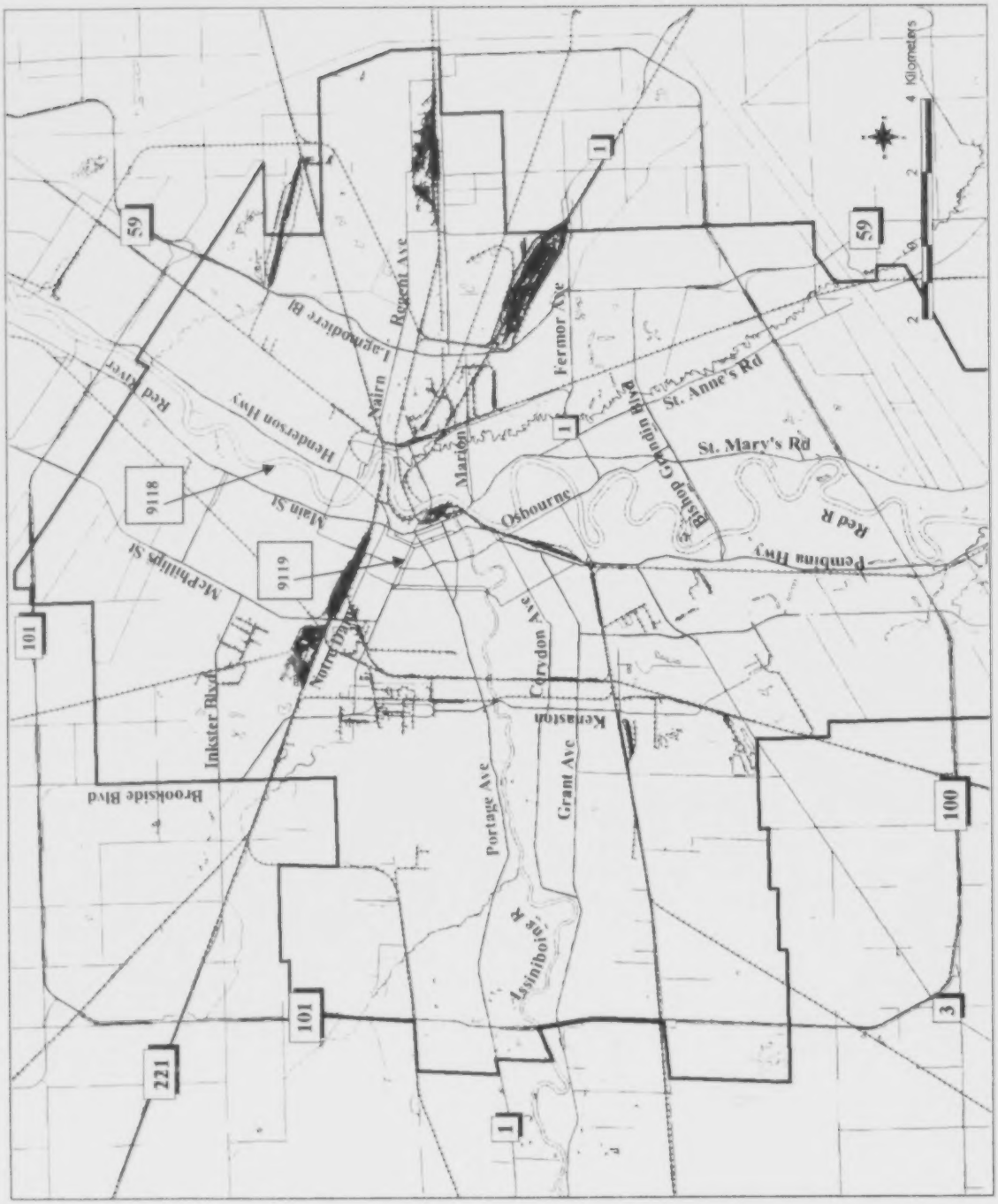

Figure 2. Winnipeg Ambient Air Monitoring Stations

Figure 3. Brandon Ambient Air Monitoring Stations.

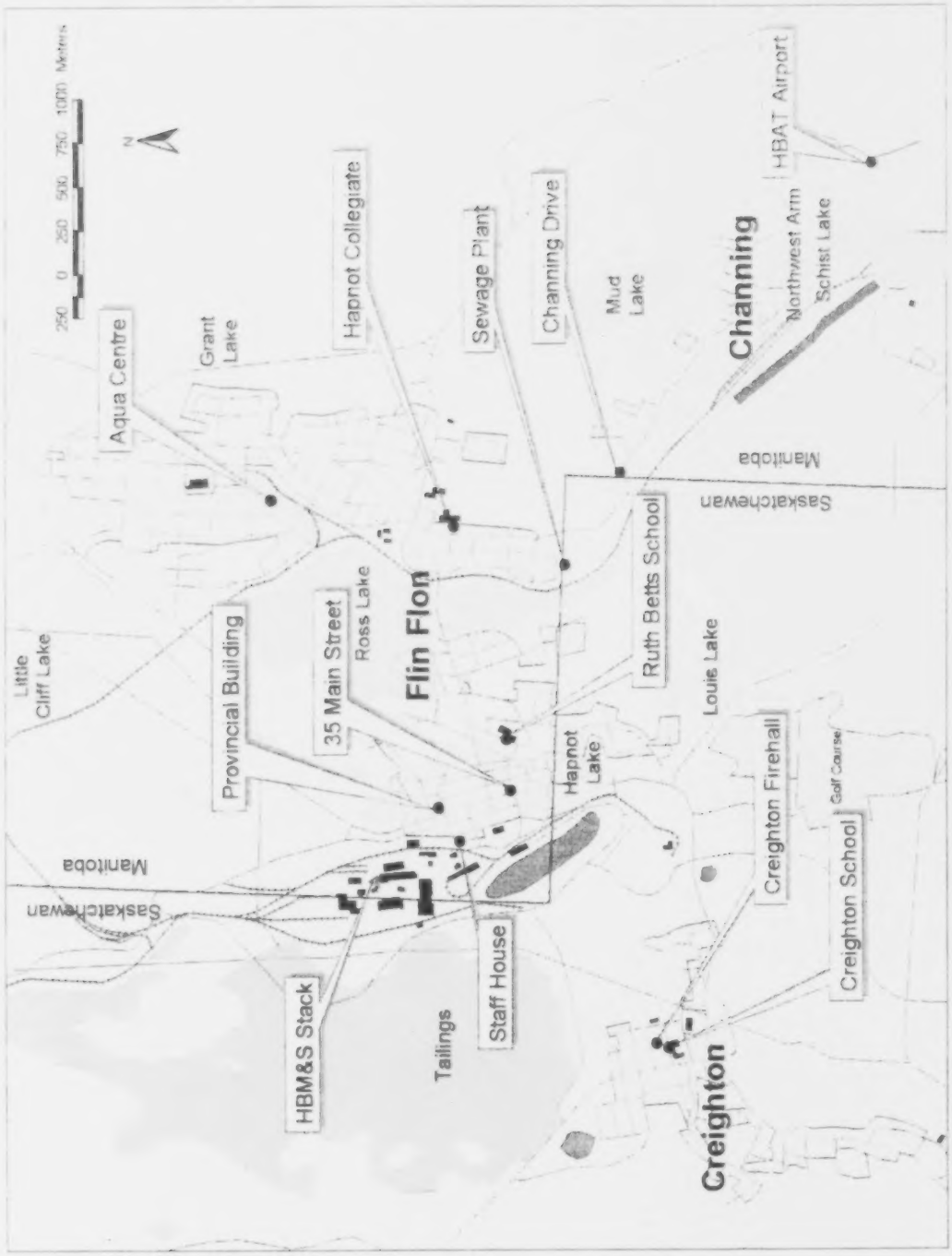

Figure 4. Flin Flon Ambient Air Monitoring Stations (both historic and current).

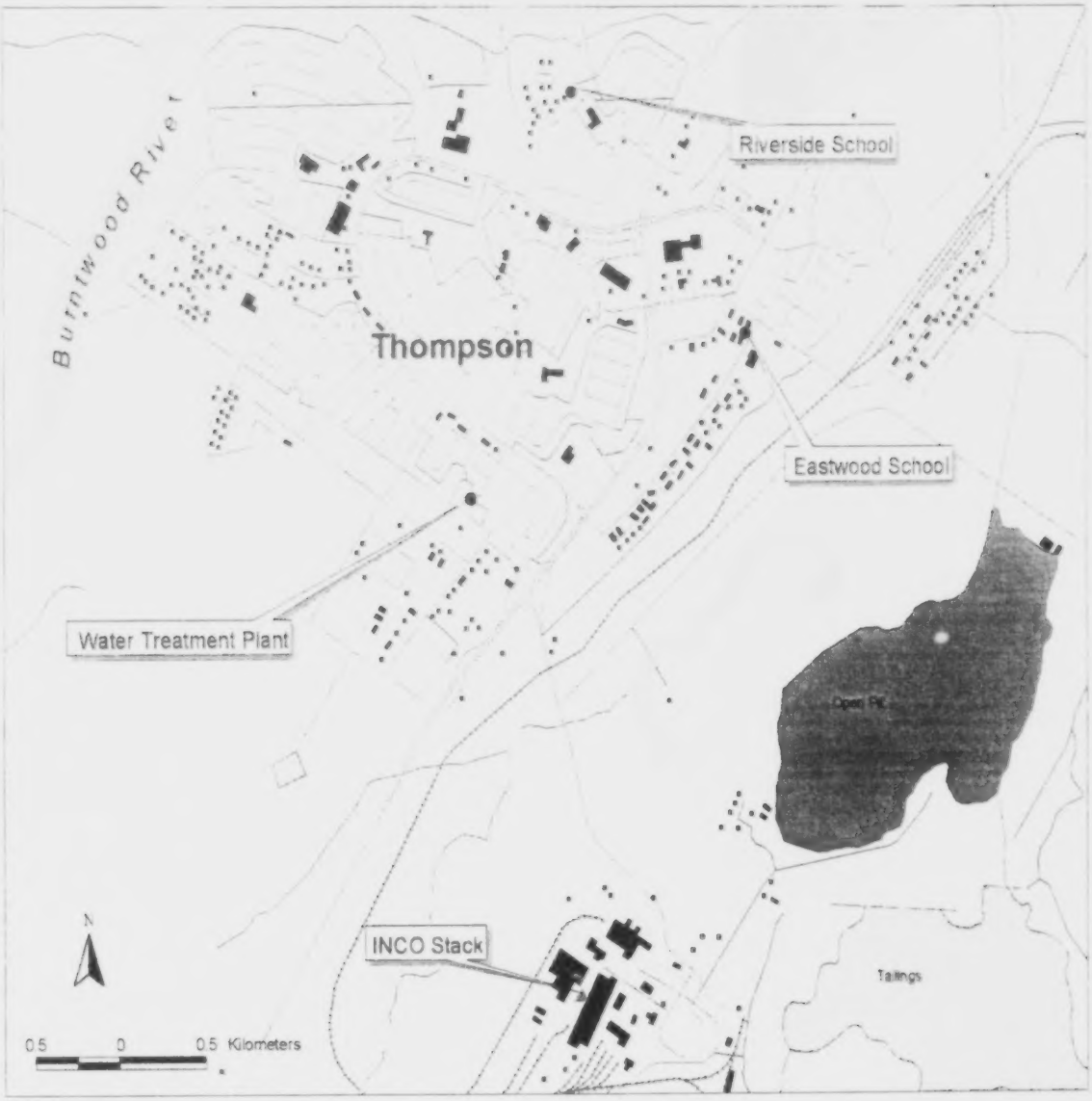

Figure 5. Thompson Ambient Air Monitoring Station.

Thompson
Open Pit
INCO Stack

D) THE INDEX OF THE QUALITY OF AIR (IQUA) or Air Quality Index (AQI)

The method for determining air quality indices is based on the Federal/Provincial draft document entitled "Guideline for the Index of the Quality of the Air (August 1993)". This document has been published in report form and can be obtained from Environment Canada (Report EPS 1/AP/3 April 1996). Formulas have been developed to assign air quality indices for all the pollutants for which National Objectives have been set. Although no objective currently exists for PM_{10}, a formula was developed based on the COH level. A general description of the IQUA is as follows:

SHORT TERM INDEX

The index is derived from Canadian National Air Quality Objectives and provides a scale consistent with all areas in Canada. Effects, such as on human health, vegetation, and public perception, provide the bases for establishing the index. In some cases, the effects may not be easily observed by the general public.

Determining the Index

The concentrations of the individual pollutants are converted to a common scale such that an IQUA value of 0 corresponds to a zero level; a value of 25 to a level equal to the Maximum Desirable Air Quality Objective (MDL); a value of 50 to a level equal to the Maximum Acceptable Objective (MAL); and a value of 100 to a level equal to the Maximum Tolerable Objective (MTL). The maximum determined sub-index is the value of the IQUA. The index indicates the worst effect of the pollutants being monitored. The breakpoints between the various Objective levels describing the general air quality are shown as follows:

Breakpoint Description	Objective Level	Numerical Value
GOOD	MDL	0 - 25
FAIR	MAL	26 - 50
POOR	MTL	51 - 100
VERY POOR		> 100

ANNUAL INDEX

The annual index is in the same form and consistent with the short term index. It reflects the long term air quality, indicates trends, and permits comparison with other areas in Canada. The annual index is the average value of the short term indices measured throughout the year.

Winnipeg's Air Quality Index:

The AQI is derived from valid air quality data from two National Air Pollution Surveillance (NAPS) Class 1 stations located in a residential area and a downtown area of Winnipeg. The index is designed to describe the general quality of air in urban centres, not the condition of the air downwind from a specific source of emissions.

In the spring of 1995, Manitoba Environment in partnership with Environment Canada began dissemination of its monitoring data from the downtown station through the Air Quality Index (AQI) for Winnipeg. The data gathered at the downtown monitoring site are accessed by Environment Canada on an hourly basis and an AQI sub-index is calculated for each of the pollutants. The pollutant with the highest sub-index becomes that hour's determining factor and the value becomes the AQI. The AQI is available to the public in two ways: it can be accessed on Environment Canada's telephone weather service; and by way of the local cable television network's Environment Canada weather channel.

RESULTS

EXPLANATION OF DATA STATISTICS

The summary statistics that appear on Tables 2 to 7 are designed to outline, in brief, a profile of the annual air pollutant concentration levels at specific sites with comparison to Manitoba Air Quality Criteria, where applicable criteria are available.

Immediately below the pollutant is the indication of the units in which the air pollutant concentration levels are reported. Each air sampling site is identified by a station number and location. More information on the specific sampling site can be found by referring to Table 1.

The quantity of data available from which the calculated statistics are drawn is indicated by the two following references:

"# of months of data" - this refers to the number of months in the year for which at least 75% of the data are valid and available (not applicable to non-continuous measurements such as TSP, Pb, sulphates, and nitrates).

"Percent of data available" - this refers to the percentage of unit data (e.g. hourly averages) per year that are valid and available.

These two statistics are reflective of the representativeness of the data statistics for that year. To representatively reflect annual air quality, two months of each quarter and 75% of the total annual data should be available for statistical calculation.

The "Percentile Distribution" is the data distribution of the unit data as shown (i.e. hourly for most pollutants, 24-hour integrated samples for TSP, PM_{10}, $PM_{2.5}$, Pb, $SO_4^=$, and NO_3^-). The pth percentile (e.g. 10%) is the pollutant concentration such that p% (e.g. 10%) of the data values are less than that indicated value of pollutant concentration and (100-p%) (e.g. 90%) are greater.

The annual mean is an arithmetic mean (unless otherwise shown) of the available unit data values. The maximum data values are the highest levels present or calculated for the time period listed within the

year shown. Other than for the unit data, longer time-based averages are arithmetic and are running averages of consecutive unit data and can overlap for days and/or months. For example, 24-hour running samples are based on increments of one hour and could result in a maximum of 24 hours/day x 365 days = 8760 24-hour sampling periods within a year. At least 75% of the data values within one running period must be available for the calculation of that running mean average.

A comparison of the data to the Manitoba Ambient Air Criteria is shown under the heading "# of Samples Above MDL/MAL/MTL". This listing is a count of the number of time-based averages or unit data concentrations that are larger than the appropriate time-based objective or guideline level.

Tables 2-7 show the statistical annual results of monitoring at the various stations during 2000-2002.

Tables 8-10 show the statistical analyses of the 24-hour average VOC samples collected in 2000-2002. The columns show the compound analyzed, the number of samples analyzed, the arithmetic mean, the standard deviation, the median, and the maximum and minimum values recorded during the year.

Table 11 shows the statistical analyses of the 24-hour average PAH samples collected in 2000-02. The columns show the compound analyzed, the number of samples analyzed, the arithmetic mean, the standard deviation, the median, and the maximum and minimum values recorded during the three year period.

Table 12 shows the statistical analyses of the 24-hour average polychlorinated dibenzodioxin/dibenzofuran samples collected for the period January 2000 through to December 2002. The columns show the compound analyzed, the number of samples analyzed, the arithmetic mean, the standard deviation, the median, and the maximum and minimum values recorded during the three year period.

Table 13 shows the statistical analyses of the 24-hour average Aldehyde/ketone samples collected from January, 2000 through December 2002. The columns show the compound analyzed, the arithmetic mean, the median, the maximum and minimum values recorded during the three year period and the number of samples in which the compound or family of compounds were detected.

Table 2 Manitoba Ambient Air Quality Data - **2000** Annual Pollutant Summary - Continuous Monitoring

POLLUTANT Conc. Units	STATION NUMBER & LOCATION	# OF MONTHS AVAIL.	PERCENT OF DATA AVAIL.	PERCENTILE DISTRIBUTION (1-HOUR SAMPLES) 10%	30%	50%	70%	90%	99%	ANNUAL MEAN	MAXIMUM DATA VALUES 1-HR	24-HR	# OF SAMPLES ABOVE M.D.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.A.I. 1-HR	24 HR	# OF SAMPLES ABOVE M.T.L. 1-HR	24-HR
CARBON MONOXIDE (CO) ppm	9118 WINNIPEG, SCOTIA & JEFFERSON	12	94.9%	0.2	0.3	0.4	0.5	0.7	1.5	0.48	4.1	2.4$^{\Delta}$	0	0$^{\Delta}$	0	0$^{\Delta}$	--	0$^{\Delta}$
	9119 WINNIPEG, 65 ELLEN STREET	12	94.8%	0.3	0.4	0.5	0.6	0.9	1.6	0.57	4.4	2.4$^{\Delta}$	0	0$^{\Delta}$	0	0$^{\Delta}$	--	0$^{\Delta}$
NITROGEN DIOXIDE (NO_2) pphm	5131 BRANDON, ASSIN. COMMUN. COLLEGE	10	82.7%	0.1	0.2	0.5	0.8	1.6	3.2	0.69	7.1	3.0	--	--	0	0	0	--
	9118 WINNIPEG, SCOTIA & JEFFERSON	12	95.2%	0.5	0.7	0.9	1.4	2.6	4.3	1.24	5.8	3.7	--	--	0	0	0	--
	9119 WINNIPEG, 65 ELLEN STREET	12	93.7%	0.6	1.0	1.5	2.0	3.1	4.6	1.66	7.1	4.6	--	--	0	0	0	--
NITRIC OXIDE (NO) pphm	5131 BRANDON, ASSIN. COMMUN. COLLEGE	10	82.7%	0.0	0.0	0.1	0.3	0.9	4.2	0.38	14.2	4.9	--	--	--	--	--	--
	9118 WINNIPEG, SCOTIA & JEFFERSON	12	95.2%	0.0	0.1	0.2	0.3	1.2	8.2	0.62	27.0	6.9	--	--	--	--	--	--
	9119 WINNIPEG, 65 ELLEN STREET	12	93.7%	0.1	0.3	0.6	1.0	2.7	8.1	1.10	25.7	7.5	--	--	--	--	--	--
NITROGEN OXIDES (NOX) pphm	5131 BRANDON, ASSIN. COMMUN. COLLEGE	10	82.7%	0.0	0.3	0.5	1.0	2.3	7.0	0.96	18.3	7.6	--	--	--	--	--	--
	9118 WINNIPEG, SCOTIA & JEFFERSON	12	95.2%	0.4	0.6	0.9	1.6	3.6	11.7	1.69	32.1	10.5	--	--	--	--	--	--
	9119 WINNIPEG, 65 ELLEN STREET	12	93.7%	0.7	1.2	1.8	2.9	5.2	11.6	2.55	31.7	10.3	--	--	--	--	--	--
SULPHUR DIOXIDE (SO_2) ppm	7251 FLIN FLON, 143 MAIN STREET	12	94.9%	0.00	0.00	0.00	0.00	0.02	0.39	0.02	1.45	0.29	230	573	104	244	--	0
	7271• FLIN FLON, AQUA CENTRE	12	95.8%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.02	0	0	0	0	--	0
	7281• FLIN FLON, HBM&S STAFFHOUSE	12	95.6%	0.00	0.00	0.00	0.00	0.00	0.27	0.01	0.97	0.23	164	364	66	156	--	0
	7291• CREIGHTON, SASK. CITY HALL	12	95.8%	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.63	0.11	21	44	6	0	--	0
	7301• FLIN FLON, HAPNOT COLLEGIATE	12	94.9%	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.68	0.12	25	23	7	3	--	0
	7351• THOMPSON, WATER TREATMENT PLANT	12	98.6%	0.00	0.00	0.00	0.00	0.00	0.07	0.00	1.02	0.12	46	45	14	18	--	0
OXIDANTS OZONE (O_3) pphm	5131 BRANDON, ASSIN. COMMUN. COLLEGE	12	93.7%	1.1	2.0	2.6	3.2	4.0	5.3	2.58	6.2	4.6	141	~	0	~	0	--
	9118 WINNIPEG, SCOTIA & JEFFERSON	12	94.6%	0.5	1.4	2.0	2.6	3.6	4.8	2.05	6.1	4.5	48	~	0	~	0	--
	9119 WINNIPEG, 65 ELLEN STREET	12	94.9%	0.1	0.7	1.2	1.8	2.8	4.0	1.35	5.2	3.6	2	~	0	~	0	--
AMMONIA (NH_3) ppm	5131 BRANDON, ASSIN. COMMUN. COLLEGE	12	94.1%	0.0	0.0	0.0	0.0	0.0	0.3	0.01	3.1	0.4	--	--	1	--	--	--

$^{\Delta}$ averaged over 8 hours • denotes company supplied data -- no guideline or objective ~ numerous exceedences of the 24 hour MDL and MAL which are currently under review

Table 3a Manitoba Ambient Air Quality Data - **2000** Annual Pollutant Summary - Particulate Matter Monitoring (PM_{10})

POLLUTANT	STATION NUMBER & LOCATION	Collection Duration	% Data or # OF SAMPLES	PERCENTILE DISTRIBUTION 10%	30%	50%	70%	90%	99%	ANNUAL ARITH/GEO MEAN	MAXIMUM DATA VALUES 24/1-HR	# OF SAMPLES ABOVE M.D.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.A.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.T.L. 1-HR	24-HR
INHALABLE PARTICULATE (PM_{10})	7251[4] FLIN FLON, 143 MAIN STREET	1-Hr	76.2%	4.8	8.6	13.9	23.4	55.0	159.7	24.2 / -	123.7 / 440.7	--	--	--	27[5]	--	--
	7284[1] FLIN FLON, RUTH BETTS	24-Hr	58	4.9	7.2	10.6	14.5	23.7	32.7	12.4 / 10.3	36.0 / -	--	--	--	0[5]	--	--
	7285[1] FLIN FLON, CENTOBA/SEWAGE PLANT	24-Hr	57	4.9	7.7	10.1	12.9	19.3	41.9	12.2 / 10.0	42.1 / -	--	--	--	0[5]	--	--
	9119[4] WINNIPEG, 65 ELLEN STREET	1-Hr	93.7%	5.0	9.0	13.4	21.4	39.1	77.8	18.7 / -	62 / 233	--	--	--	7[5]	--	--
	9119[1] WINNIPEG, 65 ELLEN STREET	24-Hr	42	7.8	13.0	18.6	24.0	38.6	43.8	20.2 / 16.6	44.7 / -	--	--	--	0[5]	--	--
	5131[4] BRANDON, ASSIN. COMMUN. COLLEGE	1-Hr	79.0%	4.0	7.5	11.9	19.6	42.8	121.6	19.8 / -	143.0 / 498.0	--	--	--	26[5]	--	--
LEAD (Pb)	7284[1] FLIN FLON, RUTH BETTS	24-Hr	9	0.025	0.068	0.209	0.234	1.132	1.786	0.410 / 153	1.859 / -	--	--	--	0	--	--
	7285[1] FLIN FLON, CENTOBA/SEWAGE PLANT	24-Hr	8	0.024	0.025	0.047	0.405	0.561	0.631	0.222 / 0.087	0.639 / -	--	--	--	0	--	--
SULPHATES ($SO_4^{=}$)	7284[1] FLIN FLON, RUTH BETTS	24-Hr	9	0.452	1.183	2.374	3.139	4.383	5.455	2.389 / 1.669	5.574 / -	--	--	--	--	--	--
	7285[1] FLIN FLON, CENTOBA/SEWAGE PLANT	24-Hr	8	0.445	0.543	1.148	2.494	3.000	3.402	1.568 / 1.147	3.446 / -	--	--	--	--	--	--
ARSENIC (As)	7284[1] FLIN FLON, RUTH BETTS	24-Hr	9	0.005	0.015	0.027	0.045	0.096	0.157	0.044 / 0.024	0.166 / -	--	--	--	0[5]	--	--
	7285[1] FLIN FLON, CENTOBA/SEWAGE PLANT	24-Hr	8	0.000	0.003	0.005	0.028	0.085	0.159	0.033 / 0.007	0.167 / -	--	--	--	0[5]	--	--
CADMIUM (Cd)	7284[1] FLIN FLON, RUTH BETTS	24-Hr	9	0.003	0.006	0.012	0.028	0.101	0.259	0.046 / 0.015	0.276 / -	--	--	--	0[5]	--	--
	7285[1] FLIN FLON, CENTOBA/SEWAGE PLANT	24-Hr	8	0.003	0.003	0.010	0.049	0.089	0.107	0.034 / 0.013	0.109 / -	--	--	--	0[5]	--	--
COPPER (Cu)	7284[1] FLIN FLON, RUTH BETTS	24-Hr	9	0.045	0.100	0.142	0.157	0.338	0.509	0.174 / 0.129	0.528 / -	--	--	--	0[5]	--	--
	7285[1] FLIN FLON, CENTOBA/SEWAGE PLANT	24-Hr	8	0.024	0.039	0.054	0.120	0.358	0.609	0.149 / 0.072	0.637 / -	--	--	--	0[5]	--	--
ZINC (Zn)	7284[1] FLIN FLON, RUTH BETTS	24-Hr	9	0.006	0.176	0.376	0.521	1.429	2.672	0.627 / 0.191	2.810 / -	--	--	--	0[5]	--	--
	7285[1] FLIN FLON, CENTOBA/SEWAGE PLANT	24-Hr	8	0.006	0.010	0.058	0.124	0.870	1.509	0.301 / 0.055	1.580 / -	--	--	--	0[5]	--	--

Table 3b Manitoba Ambient Air Quality Data - **2000** Annual Pollutant Summary - Particulate Matter Monitoring ($PM_{2.5}$)

POLLUTANT	STATION NUMBER & LOCATION	Collection Duration	% Data or # OF SAMPLES	PERCENTILE DISTRIBUTION 10%	30%	50%	70%	90%	99%	ANNUAL ARITH/GEO MEAN	MAXIMUM DATA VALUES 24/1-HR	# OF SAMPLES ABOVE M.D.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.A.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.T.L. 1-HR	24-HR
INHALABLE PARTICULATE ($PM_{2.5}$)	9118[4] WINNIPEG, SCOTIA & JEFFERSON	1-Hr	98.6%	1.2	3.0	4.6	6.8	11.3	21.9	5.7 / -	18.2 / 46.3	--	--	--	--	--	--
	9119[4] WINNIPEG, 65 ELLEN STREET	1-Hr	94%	0.7	2.1	3.3	4.8	8.8	17.9	4.2 / -	9.1 / 32.6	--	--	--	--	--	--
	9119[1] WINNIPEG, 65 ELLEN STREET	24-Hr	42	2.7	4.4	5.4	7.0	10.5	16.7	6.2 / 5.2	18.3 / -	--	--	--	--	--	--

Notes: All Concentration units for the above Tables 3a & 3b are in ug/m^3 -- no guideline or objective

[1] – 24 Hour sample collected every six days according to NAPS schedule [4] – real-time continuous monitoring [5] Ontario 24-hour Criteria

Table 3c Manitoba Ambient Air Quality Data - **2000** Annual Pollutant Summary - Particulate Matter Monitoring (TSP)

POLLUTANT	STATION NUMBER & LOCATION	Collection Duration	% Data or # OF SAMPLES	PERCENTILE DISTRIBUTION 10%	30%	50%	70%	90%	99%	ANNUAL ARITH/GEO MEAN	MAXIMUM DATA VALUES 24-HR	# OF SAMPLES ABOVE M.D.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.A.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.T.L. 1-HR	24-HR
TOTAL SUSPENDED PARTICULATE (TSP)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	204	11	24	38	59	108	170	49 / 36	184	--	--	--	10	--	0
	7283[2*] CREIGHTON, SCHOOL	24-Hr	119	12	17	25	37	65	185	34 / 26	216	--	--	--	2	--	0
	7284[2*] FLIN FLON, RUTH BETTS	24-Hr	115	9	15	22	34	52	80	28 / 22	100	--	--	--	0	--	0
	7285[2*] FLIN FLON, CENTOBA/SEWAGE PLANT	24-Hr	119	10	14	20	30	45	115	26 / 21	123	--	--	--	1	--	0
	9118[1] WINNIPEG, 299 SCOTIA STREET	24-Hr	58	9	16	26	38	49	67	28 / 23	73	--	--	--	0	--	0
	9119[1,3] WINNIPEG, 65 ELLEN STREET	24-Hr	238	13	25	42	59	93	139	48 / 37	181	--	--	--	9	--	0
LEAD (Pb)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	204	0.03	0.03	0.05	0.17	1.12	4.34	0.36 / 0.10	5.05	--	--	--	1	--	--
	7283[2*] CREIGHTON, SCHOOL	24-Hr	26	0.02	0.02	0.03	0.15	0.49	0.85	0.16 / 0.07	0.89	--	--	--	0	--	--
	7284[2*] FLIN FLON, RUTH BETTS	24-Hr	17	0.02	0.04	0.19	0.57	1.53	1.73	0.48 / 0.18	1.73	--	--	--	0	--	--
	7285[2*] FLIN FLON, CENTOBA/SEWAGE PLANT	24-Hr	22	0.02	0.03	0.05	0.13	0.48	1.17	0.18 / 0.08	1.33	--	--	--	0	--	--
SULPHATES ($SO_4^=$)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	204	0.52	1.06	1.97	3.60	8.41	16.69	3.29 / 2.03	17.65	--	--	--	--	--	--
	7283[2*] CREIGHTON, SCHOOL	24-Hr	26	0.49	1.00	1.59	2.24	3.41	3.74	1.76 / 1.37	3.76	--	--	--	--	--	--
	7284[2*] FLIN FLON, RUTH BETTS	24-Hr	17	1.01	1.65	2.64	3.94	4.93	6.24	2.87 / 2.32	6.41	--	--	--	--	--	--
	7285[2*] FLIN FLON, CENTOBA/SEWAGE PLANT	24-Hr	22	0.54	1.27	1.70	2.58	3.40	3.98	1.89 / 1.56	4.07	--	--	--	--	--	--
NITRATES (NO_3^-)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	204	0.05	0.06	0.10	0.17	0.41	1.28	0.19 / 0.12	2.05	--	--	--	--	--	--
ARSENIC (As)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	204	0.003	0.006	0.011	0.031	0.141	0.370	0.043 / 0.014	0.566	--	--	--	4[5]	--	--
	7283[2*] CREIGHTON, SCHOOL	24-Hr	26	0.001	0.004	0.012	0.035	0.089	0.310	0.045 / 0.012	0.316	--	--	--	1[5]	--	--
	7284[2*] FLIN FLON, RUTH BETTS	24-Hr	17	0.006	0.013	0.038	0.068	0.167	0.187	0.059 / 0.032	0.189	--	--	--	0[5]	--	--
	7285[2*] FLIN FLON, CENTOBA/SEWAGE PLANT	24-Hr	22	0.001	0.005	0.008	0.017	0.118	0.175	0.033 / 0.010	0.182	--	--	--	0[5]	--	--
CADMIUM (Cd)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	204	0.003	0.003	0.005	0.021	0.147	0.468	0.050 / 0.011	1.039	--	--	--	0[5]	--	--
	7283[2*] CREIGHTON, SCHOOL	24-Hr	26	0.003	0.003	0.003	0.011	0.052	0.144	0.020 / 0.007	0.159	--	--	--	0[5]	--	--
	7284[2*] FLIN FLON, RUTH BETTS	24-Hr	17	0.003	0.008	0.014	0.079	0.132	0.252	0.055 / 0.021	0.274	--	--	--	0[5]	--	--
	7285[2*] FLIN FLON, CENTOBA/SEWAGE PLANT	24-Hr	22	0.003	0.003	0.008	0.018	0.054	0.156	0.026 / 0.010	0.167	--	--	--	0[5]	--	--
COPPER (Cu)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	204	0.125	0.257	0.392	0.687	1.654	4.427	0.723 / 0.428	5.563	--	--	--	0[5]	--	--
	7283[2*] CREIGHTON, SCHOOL	24-Hr	26	0.146	0.258	0.335	0.451	0.657	0.801	0.381 / 0.328	0.823	--	--	--	0[5]	--	--
	7284[2*] FLIN FLON, RUTH BETTS	24-Hr	17	0.413	0.635	0.991	1.246	1.908	2.273	1.050 / 0.884	2.323	--	--	--	0[5]	--	--
	7285[2*] FLIN FLON, CENTOBA/SEWAGE PLANT	24-Hr	22	0.208	0.393	0.499	0.610	0.889	1.810	0.565 / 0.471	2.047	--	--	--	0[5]	--	--
ZINC (Zn)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	204	0.230	0.369	0.720	1.840	5.255	12.290	1.857 / 0.914	13.180	--	--	--	0[5]	--	--
	7283[2*] CREIGHTON, SCHOOL	24-Hr	26	0.006	0.122	0.256	0.472	1.085	1.548	0.428 / 0.154	1.602	--	--	--	0[5]	--	--
	7284[2*] FLIN FLON, RUTH BETTS	24-Hr	17	0.274	0.586	0.913	1.489	2.881	3.472	1.281 / 0.731	3.492	--	--	--	0[5]	--	--
	7285[2*] FLIN FLON, CENTOBA/SEWAGE PLANT	24-Hr	22	0.107	0.264	0.386	0.496	1.525	2.323	0.589 / 0.316	2.428	--	--	--	0[5]	--	--

Notes: All Concentration units for the above Table 3c are in ug/m^3. -- no guideline or objective *- company supplied data

[1] – 24 Hour sample collected every six days according to NAPS schedule [2] – 24 Hour sample collected every three days, synchronized with the NAPS schedule [3] – 3 additional samples collected every NAPS cycle

[5] – Ontario 24-hour criteria

Table 4 Manitoba Ambient Air Quality Data - **2001** Annual Pollutant Summary - Continuous Monitoring

POLLUTANT Conc. Units	STATION NUMBER & LOCATION	# OF MONTHS AVAIL.	PERCENT OF DATA AVAIL.	PERCENTILE DISTRIBUTION (1-HOUR SAMPLES) 10%	30%	50%	70%	90%	99%	ANNUAL MEAN	MAXIMUM DATA VALUES 1-HR	24-HR	# OF SAMPLES ABOVE M.D.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.A.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.T.L. 1-HR	24-HR
CARBON MONOXIDE (CO) ppm	9118 WINNIPEG, SCOTIA & JEFFERSON	12	93.8%	0.2	0.3	0.4	0.8	0.8	1.7	0.46	7.0	3.5*	0	0*	0	0*	--	0*
	9119 WINNIPEG, 65 ELLEN STREET	12	94.3%	0.3	0.5	0.6	0.8	1.1	2.0	0.67	4.5	2.8*	0	0*	0	0*	--	0*
NITROGEN DIOXIDE (NO_2) pphm	5131 BRANDON, ASSIN. COMMUN. COLLEGE	12	93.8%	0.0	0.1	0.3	0.6	1.4	3.0	0.52	7.9	3.0	--	--	0	0	0	--
	9118 WINNIPEG, SCOTIA & JEFFERSON	12	94.9%	0.4	0.6	0.9	1.4	2.5	4.4	1.22	6.9	4.0	--	--	0	0	0	--
	9119 WINNIPEG, 65 ELLEN STREET	11	91.8%	0.5	0.8	1.2	1.7	2.7	4.3	1.43	6.2	4.4	--	--	0	0	0	--
NITRIC OXIDE (NO) pphm	5131 BRANDON, ASSIN. COMMUN. COLLEGE	12	93.8%	0.1	0.1	0.2	0.4	1.0	5.1	0.49	27.9	5.7	--	--	--	--	--	--
	9118 WINNIPEG, SCOTIA & JEFFERSON	12	94.9%	0.1	0.3	0.4	0.5	1.4	8.2	0.77	40.8	8.6	--	--	--	--	--	--
	9119 WINNIPEG, 65 ELLEN STREET	11	91.8%	0.1	0.3	0.5	0.9	2.3	10.9	1.10	34.2	15.4	--	--	--	--	--	--
NITROGEN OXIDES (NOx) pphm	5131 BRANDON, ASSIN. COMMUN. COLLEGE	12	93.8%	0.0	0.2	0.5	0.9	2.3	8.1	0.98	31.2	7.9	--	--	--	--	--	--
	9118 WINNIPEG, SCOTIA & JEFFERSON	12	94.9%	0.6	0.8	1.1	1.7	3.8	11.6	1.83	47.6	12.5	--	--	--	--	--	--
	9119 WINNIPEG, 65 ELLEN STREET	11	91.8%	0.7	1.2	1.7	2.6	4.8	14.3	2.48	40.1	19.5	--	--	--	--	--	--
SULPHUR DIOXIDE (SO_2) ppm	7251 FLIN FLON, 143 MAIN STREET	11	88.6%	0.00	0.00	0.00	0.00	0.00	0.13	0.01	0.52	0.19	56	124	7	27	--	0
	7271* FLIN FLON, AQUA CENTRE	12	95.8%	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.54	0.06	22	0	8	0	--	0
	7281* FLIN FLON, HBM&S STAFFHOUSE	12	95.8%	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.47	0.09	30	42	4	0	--	0
	7291* CREIGHTON, SASK. CITY HALL	12	94.7%	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.55	0.11	17	23	6	0	--	0
	7301* FLIN FLON, HAPNOT COLLEGIATE	12	95.6%	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.33	0.03	4	0	0	0	--	0
	7351* THOMPSON, WATER TREATMENT PLANT	12	97.0%	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.32	0.04	9	0	0	0	--	0
OXIDANTS OZONE (O_3) pphm	5131 BRANDON, ASSIN. COMMUN. COLLEGE	12	94.8%	1.1	2.0	2.7	3.3	4.1	5.2	2.64	6.3	4.6	114	~	0	~	0	--
	9118 WINNIPEG, SCOTIA & JEFFERSON	12	95.1%	0.3	1.2	1.9	2.6	3.5	4.6	1.94	6.1	4.8	35	~	0	~	0	--
	9119 WINNIPEG, 65 ELLEN STREET	11	89.3%	0.2	0.9	1.5	2.2	3.1	4.4	1.61	6.7	4.2	34	~	0	~	0	--
AMMONIA (NH_3) ppm	5131 BRANDON, ASSIN. COMMUN. COLLEGE	12	93.8%	0.0	0.0	0.0	0.0	0.0	0.5	0.02	2.7	0.5	--	--	5	--	--	--

Δ averaged over 8 hours * denotes company supplied data -- no guideline or objective ~ numerous exceedences of the 24 hour MDL and MAL which are currently under review

Table 5a Manitoba Ambient Air Quality Data - **2001** Annual Pollutant Summary - Particulate Matter Monitoring (PM_{10})

POLLUTANT	STATION NUMBER & LOCATION	Collection Duration	% Data or # OF SAMPLES	PERCENTILE DISTRIBUTION 10%	30%	50%	70%	90%	99%	ANNUAL ARITH/GEO MEAN	MAXIMUM DATA VALUES 24/1-HR	# OF SAMPLES ABOVE M.D.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.A.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.T.L. 1-HR	24-HR
INHALABLE PARTICULATE (PM_{10})	7251[4] FLIN FLON, 143 MAIN STREET	1-Hr	87.6%	4.4	7.7	12.3	21.1	51.2	148.1	22.5 / -	197.6 / 500.0	--	--	--	28[6]	--	--
	7284[1] FLIN FLON, RUTH BETTS	24-Hr	58	7.0	8.9	11.2	14.8	24.0	55.1	14.8 / 12.3	66.0 / -	--	--	--	1[6]	--	--
	7285[1] FLIN FLON, SEWAGE PLANT	24-Hr	57	4.9	6.6	9.0	11.1	18.3	25.7	10.3 / 9.0	28.4 / -	--	--	--	0[6]	--	--
	9119[4] WINNIPEG, 65 ELLEN STREET	1-Hr	99.5%	5.3	9.4	14.1	21.5	38.1	82.1	19.0 / -	93.9 / 398.4	--	--	--	9[6]	--	--
	9119[1] WINNIPEG, 65 ELLEN STREET	24-Hr	56	6.8	13.6	16.6	22.2	30.7	47.0	18.9 / 16.2	49.7 / -	--	--	--	0[6]	--	--
	5131[4] BRANDON, ASSIN. COMMUN. COLLEGE	1-Hr	96.5%	4.1	8.2	13.4	23.1	48.0	140.4	22.3 / -	131.4 / 451.5	--	--	--	26[6]	--	--
LEAD (Pb)	7284[1] FLIN FLON, RUTH BETTS	24-Hr	12	0.034	0.097	0.246	0.291	0.485	0.588	0.245 / 0.162	0.600 / -	--	--	--	0	--	--
	7285[1] FLIN FLON, SEWAGE PLANT	24-Hr	10	0.022	0.078	0.115	0.249	0.473	0.502	0.191 / 0.121	0.506 / -	--	--	--	0	--	--
SULPHATES ($SO_4^=$)	7284[1] FLIN FLON, RUTH BETTS	24-Hr	12	0.679	1.135	1.567	2.187	4.495	6.040	2.127 / 1.667	6.205 / -	--	--	--	--	--	--
	7285[1] FLIN FLON, SEWAGE PLANT	24-Hr	8	0.698	1.073	1.429	1.701	2.116	2.954	1.471 / 1.316	3.047 / -	--	--	--	--	--	--
ARSENIC (As)	7284[1] FLIN FLON, RUTH BETTS	24-Hr	12	0.001	0.011	0.023	0.074	0.124	0.129	0.048 / 0.017	0.129 / -	--	--	--	0[6]	--	--
	7285[1] FLIN FLON, SEWAGE PLANT	24-Hr	10	0.000	0.012	0.023	0.045	0.109	0.182	0.046 / 0.015	0.190 / -	--	--	--	0[6]	--	--
CADMIUM (Cd)	7284[1] FLIN FLON, RUTH BETTS	24-Hr	12	0.004	0.018	0.049	0.066	0.124	0.180	0.060 / 0.031	0.187 / -	--	--	--	0[6]	--	--
	7285[1] FLIN FLON, SEWAGE PLANT	24-Hr	10	0.003	0.024	0.038	0.049	0.084	0.099	0.042 / 0.025	0.101 / -	--	--	--	0[6]	--	--
COPPER (Cu)	7284[1] FLIN FLON, RUTH BETTS	24-Hr	12	0.070	0.166	0.384	0.624	1.120	1.490	0.503 / 0.300	1.532 / -	--	--	--	0[6]	--	--
	7285[1] FLIN FLON, SEWAGE PLANT	24-Hr	10	0.041	0.084	0.237	0.324	0.471	0.511	0.234 / 0.157	0.516 / -	--	--	--	0[6]	--	--
ZINC (Zn)	7284[1] FLIN FLON, RUTH BETTS	24-Hr	12	0.169	0.429	0.796	1.167	1.413	3.128	0.939 / 0.584	3.338 / -	--	--	--	0[6]	--	--
	7285[1] FLIN FLON, SEWAGE PLANT	24-Hr	10	0.066	0.294	0.492	0.725	0.939	0.956	0.502 / 0.286	0.958 / -	--	--	--	0[6]	--	--

Table 5b Manitoba Ambient Air Quality Data - **2001** Annual Pollutant Summary - Particulate Matter Monitoring ($PM_{2.5}$)

POLLUTANT	STATION NUMBER & LOCATION	Collection Duration	% Data or # OF SAMPLES	PERCENTILE DISTRIBUTION 10%	30%	50%	70%	90%	99%	ANNUAL ARITH/GEO MEAN	MAXIMUM DATA VALUES 24/1-HR	# OF SAMPLES ABOVE M.D.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.A.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.T.L. 1-HR	24-HR
INHALABLE PARTICULATE ($PM_{2.5}$)	9118[4] WINNIPEG, SCOTIA & JEFFERSON	1-Hr	99.1%	1.1	3.2	4.9	7.0	11.6	20.8	5.8 /	22.0 / 70.1	--	--	--	--	--	--
	9119[1] WINNIPEG, 65 ELLEN STREET	24-Hr	56	3.1	4.6	5.8	6.8	9.6	16.7	6.2 / 5.5	16.8 / -	--	--	--	--	--	--
	9119[4] WINNIPEG, 65 ELLEN STREET	1-Hr	99.3%	0.5	2.5	4.3	6.7	11.8	21.4	5.5 / -	19.5 / 70.1	--	--	--	--	--	--
	5131[4] BRANDON, ASSIN. COMMUN. COLLEGE	1-Hr	47.3%	0.2	2.3	4.3	6.9	12.6	27.0	5.8 / -	17.9 / 165.2	--	--	--	--	--	--

Notes: All Concentration units for the above Table 5a & 5b are in ug/m^3. -- no guideline or objective

[1] - 24 Hour sample collected every six days according to NAPS schedule [4] - real-time continuous monitoring [6] - Ontario 24-hour Criteria

Table 5c Manitoba Ambient Air Quality Data - **2001** Annual Pollutant Summary - Particulate Matter Monitoring (TSP)

POLLUTANT	STATION NUMBER & LOCATION	Collection Duration	% Data or # OF SAMPLES	PERCENTILE DISTRIBUTION 10%	30%	50%	70%	90%	99%	ANNUAL ARITH/GEO MEAN	MAXIMUM DATA VALUES 24-HR	# OF SAMPLES ABOVE M.D.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.A.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.T.L. 1-HR	24-HR
TOTAL SUSPENDED PARTICULATE (TSP)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	157	11	19	32	53	110	225	49 / 32	468	--	--	--	13	--	--
	7283[2*] CREIGHTON, SCHOOL	24-Hr	121	11	16	23	31	53	120	29 / 24	132	--	--	--	2	--	--
	7284[2*] FLIN FLON, RUTH BETTS	24-Hr	120	8	13	21	35	68	141	33 / 22	423	--	--	--	3	--	--
	7285[2*] FLIN FLON, SEWAGE PLANT	24-Hr	115	8	10	14	20	34	62	19 / 15	164	--	--	--	1	--	--
	9118[1] WINNIPEG, 299 SCOTIA STREET	24-Hr	60	13	19	26	33	56	85	30 / 25	97	--	--	--	0	--	--
	9119[1,3] WINNIPEG, 65 ELLEN STREET	24-Hr	240	13	25	41	59	83	124	46 / 36	155	--	--	--	3	--	--
LEAD (Pb)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	168	0.03	0.04	0.05	0.17	0.72	2.49	0.26 / 0.09	2.92	--	--	--	0	--	--
	7283[2*] CREIGHTON, SCHOOL	24-Hr	30	0.02	0.02	0.04	0.05	0.24	0.47	0.09 / 0.05	0.53	--	--	--	0	--	--
	7284[2*] FLIN FLON, RUTH BETTS	24-Hr	26	0.02	0.06	0.11	0.32	0.52	0.63	0.21 / 0.12	0.66	--	--	--	0	--	--
	7285[2*] FLIN FLON, SEWAGE PLANT	24-Hr	19	0.02	0.04	0.12	0.22	0.42	0.48	0.17 / 0.10	0.48	--	--	--	0	--	--
SULPHATES ($SO_4^=$)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	168	0.64	1.07	1.52	2.63	6.61	14.22	2.73 / 1.83	20.47	--	--	--	--	--	--
	7283[2*] CREIGHTON, SCHOOL	24-Hr	30	0.72	1.31	1.74	2.20	3.99	5.30	2.06 / 1.69	5.34	--	--	--	--	--	--
	7284[2*] FLIN FLON, RUTH BETTS	24-Hr	26	0.90	1.30	1.89	2.79	4.61	6.30	2.39 / 1.92	6.56	--	--	--	--	--	--
	7285[2*] FLIN FLON, SEWAGE PLANT	24-Hr	19	0.65	1.17	1.44	2.36	2.90	3.60	1.76 / 1.38	3.70	--	--	--	--	--	--
NITRATES (NO_3^-)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	168	0.05	0.06	0.07	0.15	0.34	1.00	0.15 / 0.10	1.61	--	--	--	--	--	--
ARSENIC (As)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	168	0.002	0.005	0.010	0.033	0.153	0.500	0.051 / 0.016	0.690	--	--	--	5[6]	--	--
	7283[2*] CREIGHTON, SCHOOL	24-Hr	30	0.001	0.004	0.014	0.026	0.102	0.143	0.031 / 0.011	0.151	--	--	--	0[6]	--	--
	7284[2*] FLIN FLON, RUTH BETTS	24-Hr	26	0.001	0.008	0.021	0.066	0.141	0.301	0.055 / 0.018	0.345	--	--	--	1[6]	--	--
	7285[2*] FLIN FLON, SEWAGE PLANT	24-Hr	19	0.00	0.008	0.028	0.037	0.076	0.188	0.038 / 0.015	0.206	--	--	--	0[6]	--	--
CADMIUM (Cd)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	168	0.003	0.004	0.005	0.016	0.132	0.505	0.048 / 0.011	0.619	--	--	--	0[6]	--	--
	7283[2*] CREIGHTON, SCHOOL	24-Hr	30	0.003	0.003	0.003	0.006	0.031	0.082	0.013 / 0.006	0.086	--	--	--	0[6]	--	--
	7284[2*] FLIN FLON, RUTH BETTS	24-Hr	26	0.003	0.008	0.025	0.050	0.109	0.164	0.040 / 0.019	0.171	--	--	--	0[6]	--	--
	7285[2*] FLIN FLON, SEWAGE PLANT	24-Hr	19	0.003	0.008	0.036	0.048	0.083	0.095	0.037 / 0.021	0.096	--	--	--	0[6]	--	--
COPPER (Cu)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	168	0.122	0.236	0.377	0.651	2.519	6.072	0.907 / 0.442	9.427	--	--	--	0[6]	--	--
	7283[2*] CREIGHTON, SCHOOL	24-Hr	30	0.226	0.321	0.505	0.669	1.332	1.571	0.628 / 0.486	1.618	--	--	--	0[6]	--	--
	7284[2*] FLIN FLON, RUTH BETTS	24-Hr	26	0.197	0.383	0.686	1.400	2.424	3.049	1.002 / 0.670	3.093	--	--	--	0[6]	--	--
	7285[2*] FLIN FLON, SEWAGE PLANT	24-Hr	19	0.240	0.502	0.690	1.047	1.438	2.276	0.840 / 0.666	2.406	--	--	--	0[6]	--	--
ZINC (Zn)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	135	0.210	0.514	1.000	2.066	4.650	9.416	1.951 / 0.991	16.270	--	--	--	0[6]	--	--
	7283[2*] CREIGHTON, SCHOOL	24-Hr	30	0.006	0.128	0.297	0.424	1.479	2.254	0.510 / 0.202	2.385	--	--	--	0[6]	--	--
	7284[2*] FLIN FLON, RUTH BETTS	24-Hr	26	0.141	0.492	0.924	1.898	2.785	5.342	1.399 / 0.831	5.835	--	--	--	0[6]	--	--
	7285[2*] FLIN FLON, SEWAGE PLANT	24-Hr	19	0.073	0.335	0.671	1.327	1.800	2.316	0.866 / 0.430	2.357	--	--	--	0[6]	--	--

Notes: All Concentration units for the above Table 5c are in ug/m^3 -- no guideline or objective *- company supplied data

[1] - 24 Hour sample collected every six days according to NAPS schedule [2] - 24 Hour sample collected every three days, synchronized with the NAPS schedule [3] - 3 additional samples collected every NAPS cycle
[6] - Ontario 24-hour Criteria

Table 6 Manitoba Ambient Air Quality Data - **2002** Annual Pollutant Summary - Continuous Monitoring

POLLUTANT Conc. Units	STATION NUMBER & LOCATION	# OF MONTHS AVAIL.	PERCENT OF DATA AVAIL.	PERCENTILE DISTRIBUTION (1-HOUR SAMPLES) 10%	30%	50%	70%	90%	99%	ANNUAL MEAN	MAXIMUM DATA VALUES 1-HR	24-HR	# OF SAMPLES ABOVE M.D.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.A.L. 1-HR	24 HR	# OF SAMPLES ABOVE M.T.L. 1-HR	24-HR
CARBON MONOXIDE (CO) ppm	9118 WINNIPEG, SCOTIA & JEFFERSON	12	95.0%	0.2	0.3	0.3	0.4	0.6	1.4	0.37	2.8	2.0*	0	0*	0	0*	--	0*
	9119 WINNIPEG, 65 ELLEN STREET	12	93.9%	0.3	0.4	0.5	0.6	0.8	1.4	0.54	4.1	2.2*	0	0*	0	0*	--	0*
NITROGEN DIOXIDE (NO_2) pphm	5131 BRANDON, ASSIN. COMMUN. COLLEGE	12	94.3%	0.2	0.3	0.4	0.6	1.2	2.7	0.58	5.0	2.7	--	--	0	0	0	--
	9118 WINNIPEG, SCOTIA & JEFFERSON	12	95.5%	0.2	0.4	0.7	1.1	2.3	3.7	0.99	6.6	4.0	--	--	0	0	0	--
	9119 WINNIPEG, 65 ELLEN STREET	12	95.2%	0.5	0.9	1.2	1.7	2.6	3.9	1.43	6.4	4.4	--	--	0	0	0	--
NITRIC OXIDE (NO) pphm	5131 BRANDON, ASSIN. COMMUN. COLLEGE	12	94.3%	0.0	0.1	0.1	0.2	0.6	4.1	0.32	13.3	5.4	--	--	--	--	--	--
	9118 WINNIPEG, SCOTIA & JEFFERSON	12	95.5%	0.0	0.1	0.1	0.2	1.0	7.2	0.49	22.8	8.3	--	--	--	--	--	--
	9119 WINNIPEG, 65 ELLEN STREET	12	95.2%	0.1	0.3	0.5	0.8	2.0	7.9	0.93	30.4	7.9	--	--	--	--	--	--
NITROGEN OXIDES (NO_X) pphm	5131 BRANDON, ASSIN. COMMUN. COLLEGE	12	94.3%	0.1	0.4	0.6	0.9	1.8	6.4	0.91	17.2	8.1	--	--	--	--	--	--
	9118 WINNIPEG, SCOTIA & JEFFERSON	12	95.5%	0.3	0.5	0.8	1.4	3.2	10.6	1.47	25.6	11.1	--	--	--	--	--	--
	9119 WINNIPEG, 65 ELLEN STREET	12	95.2%	0.7	1.2	1.7	2.5	4.4	11.1	2.33	34.7	12.1	--	--	--	--	--	--
SULPHUR DIOXIDE (SO_2) ppm	7251 FLIN FLON, 143 MAIN STREET	12	94.8%	0.00	0.00	0.00	0.00	0.02	0.17	0.01	0.99	0.17	74	96	17	25	--	0
	7271* FLIN FLON, AQUA CENTRE	12	95.7%	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.44	0.05	25	0	2	0	--	0
	7281* FLIN FLON, HBM&S STAFFHOUSE	12	94.6%	0.00	0.00	0.0	0.00	0.00	0.12	0.01	0.74	0.10	40	44	9	0	--	0
	7291* CREIGHTON, SASK. CITY HALL	12	95.7%	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.63	0.11	60	89	19	0	--	0
	7301* FLIN FLON, HAPNOT COLLEGIATE	12	95.7%	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.38	0.03	10	0	1	0	--	0
	7351* THOMPSON, WATER TREATMENT PLANT	12	95.3%	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.19	0.04	1	0	0	0	--	0
OXIDANTS OZONE (O_3) pphm	5131 BRANDON, ASSIN. COMMUN. COLLEGE	12	94.6%	1.2	2.1	2.7	3.3	4.2	5.3	2.70	6.9	4.7	144	~	0	~	0	--
	9118 WINNIPEG, SCOTIA & JEFFERSON	12	95.1%	0.3	1.3	1.9	2.5	3.5	4.8	1.94	7.2	5.0	55	~	0	~	0	--
	9119 WINNIPEG, 65 ELLEN STREET	12	95.0%	0.5	1.3	1.9	2.6	3.6	4.8	2.00	7.9	4.7	47	~	0	~	0	--
AMMONIA (NH_3) ppm	5131 BRANDON, ASSIN. COMMUN. COLLEGE	12	93.5%	0.0	0.0	0.0	0.0	0.0	0.4	0.01	3.2	0.5	--	--	2	--	--	--

Δ averaged over 8 hours * denotes company supplied data -- no guideline or objective ~ numerous exceedences of the 24 hour MDL and MAL which are currently under review

Table 7a Manitoba Ambient Air Quality Data - **2002** Annual Pollutant Summary - Particulate Matter Monitoring (PM_{10})

POLLUTANT	STATION NUMBER & LOCATION	Collection Duration	% Data or # OF SAMPLES	PERCENTILE DISTRIBUTION 10%	30%	50%	70%	90%	99%	ANNUAL ARITH/GEO MEAN	MAXIMUM DATA VALUES 24/1-HR	# OF SAMPLES ABOVE M.D.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.A.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.T.L. 1-HR	24-HR
INHALABLE PARTICULATE (PM_{10})	7251[4] FLIN FLON, 143 MAIN STREET	1-Hr	98.3%	4.2	7.3	12.1	22.5	50.8	138.9	22.6 / –	145.2 / 1359.0	--	--	--	29[6]	--	--
	7283[1,7]*CREIGHTON, SCHOOL	24-Hr	8	9.2	11.3	12.0	12.3	38.3	87.4	21 / 14	93/ –			--	1[6]	--	--
	7284[1] FLIN FLON, RUTH BETTS	24-Hr	52	4.8	8.0	11.3	14.4	24.8	38.7	13 / 11	43 / –	--	--	--	0[6]	--	--
	7285[1] FLIN FLON, SEWAGE PLANT	24-Hr	55	4.3	6.1	7.9	11.3	18.1	32.8	10 / 9	38 / –	--	--	--	0[6]	--	--
	9119[4] WINNIPEG, 65 ELLEN STREET	1-Hr	99.6%	5.2	9.5	14.8	23.0	43.0	107.9	21.4 / –	166.7 / 501.0	--	--	--	21[6]	--	--
	9119[1] WINNIPEG, 65 ELLEN STREET	24-Hr	50	7.8	12.1	15.8	20.7	34.1	54.8	18.3 / 15.5	62.6 / –	--	--	--	1[6]	--	--
	5131[4] BRANDON, ASSIN. COMMUN. COLLEGE	1-Hr	98.7%	4.2	8.1	12.9	22.0	47.5	137.9	21.9 / –	215.5 / 499.3	--	--	--	27[6]	--	--
LEAD (Pb)	7283[1,7]*CREIGHTON, SCHOOL	24-Hr	8	0.024	0.024	0.025	0.025	0.096	0.167	0.048 / 0.035	0.175	--	--	--	0[6]	--	--
	7284[1] FLIN FLON, RUTH BETTS	24-Hr	19	0.025	0.047	0.163	0.205	0.317	0.371	0.153 / 0.103	0.381	--	--	--	0[6]	--	--
	7285[1] FLIN FLON, SEWAGE PLANT	24-Hr	18	0.037	0.057	0.088	0.189	0.243	0.280	0.121 / 0.092	0.285	--	--	--	0[6]	--	--
SULPHATES ($SO_4^=$)	7283[1,7]*CREIGHTON, SCHOOL	24-Hr	8	0.296	0.682	0.824	0.877	1.839	1.860	0.932 / 0.755	1.862	--	--	--	--	--	--
	7284[1] FLIN FLON, RUTH BETTS	24-Hr	18	0.797	1.342	1.905	2.231	2.535	3.364	1.817 / 1.627	3.524	--	--	--	--	--	--
	7285[1] FLIN FLON, SEWAGE PLANT	24-Hr	18	0.941	1.180	1.764	2.214	2.306	4.000	1.775 / 1.607	4.337	--	--	--	--	--	--
ARSENIC (As)	7283[1,7]*CREIGHTON, SCHOOL	24-Hr	8	0.002	0.002	0.003	0.007	0.054	0.124	0.021 / 0.005	0.132	--	--	--	0[6]	--	--
	7284[1] FLIN FLON, RUTH BETTS	24-Hr	19	0.001	0.013	0.025	0.033	0.062	0.109	0.029 / 0.014	0.117	--	--	--	0[6]	--	--
	7285[1] FLIN FLON, SEWAGE PLANT	24-Hr	18	0.002	0.008	0.014	0.022	0.048	0.282	0.035 / 0.013	0.322	--	--	--	1[6]	--	--
CADMIUM (Cd)	7283[1,7]*CREIGHTON, SCHOOL	24-Hr	8	0.003	0.003	0.003	0.003	0.008	0.010	0.004 / 0.004	0.010	--	--	--	0[6]	--	--
	7284[1] FLIN FLON, RUTH BETTS	24-Hr	19	0.003	0.003	0.007	0.032	0.044	0.138	0.024 / 0.011	0.159	--	--	--	0[6]	--	--
	7285[1] FLIN FLON, SEWAGE PLANT	24-Hr	18	0.003	0.003	0.006	0.019	0.044	0.088	0.018 / 0.009	0.092	--	--	--	0[6]	--	--
COPPER (Cu)	7283[1,7]*CREIGHTON, SCHOOL	24-Hr	8	0.007	0.008	0.012	0.022	0.103	0.186	0.041 / 0.018	0.195	--	--	--	0[6]	--	--
	7284[1] FLIN FLON, RUTH BETTS	24-Hr	19	0.061	0.131	0.346	0.482	0.650	0.940	0.347 / 0.232	0.998	--	--	--	0[6]	--	--
	7285[1] FLIN FLON, SEWAGE PLANT	24-Hr	18	0.075	0.154	0.215	0.271	0.358	0.510	0.227 / 0.190	0.540	--	--	--	0[6]	--	--
ZINC (Zn)	7283[1,7]*CREIGHTON, SCHOOL	24-Hr	8	0.007	0.039	0.056	0.119	0.372	0.843	0.166 / 0.055	0.896	--	--	--	0[6]	--	--
	7284[1] FLIN FLON, RUTH BETTS	24-Hr	19	0.032	0.184	0.539	0.652	1.222	2.026	0.555 / 0.248	2.172	--	--	--	0[6]	--	--
	7285[1] FLIN FLON, SEWAGE PLANT	24-Hr	18	0.038	0.138	0.214	0.304	0.773	0.948	0.305 / 0.169	0.975	--	--	--	0[6]	--	--

Notes: All Concentration units for the above Table 7a are in ug/m^3. -- no guideline or objective [1] – 24 Hour sample collected every six days according to NAPS schedule
[4] – real-time continuous monitoring [6] – Ontario 24-hour guideline [7] – Sewage Plant HiVol moved to Creighton School in December

Table 7b Manitoba Ambient Air Quality Data - **2002** Annual Pollutant Summary - Particulate Matter Monitoring ($PM_{2.5}$)

POLLUTANT	STATION NUMBER & LOCATION	Collection Duration	% Data or # Of SAMPLES	PERCENTILE DISTRIBUTION 10%	30%	50%	70%	90%	99%	ANNUAL ARITH/GEO MEAN	MAXIMUM DATA VALUES 24/1-HR	# OF SAMPLES ABOVE M.D.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.A.L 1-HR	24-HR	# OF SAMPLES ABOVE M.T.L. 1-HR	24-HR
INHALABLE PARTICULATE ($PM_{2.5}$)	9118[4,5] WINNIPEG, SCOTIA & JEFFERSON	1-Hr	99.2%	1.3	2.8	4.2	6.4	11.6	24.7	5.7 / –	33.6 / 101.2	--	--	--	--	--	--
	9119[1] WINNIPEG, 65 ELLEN STREET	24-Hr	50	3.7	4.5	5.7	6.7	10.4	18.5	6.5 / 5.8	18.7 / –	--	--	--	--	--	--
	9119[4] WINNIPEG, 65 ELLEN STREET	1-Hr	99.1%	1.3	2.9	4.6	6.7	12.0	32.7	6.2 / –	36.2 / 88.7	--	--	--	--	--	--
	5131[4] BRANDON, ASSIN. COMMUN. COLLEGE	1-Hr	99.2%	0.6	2.1	3.6	5.6	11.0	29.6	5.2 / –	25.6 / 166.1	--	--	--	--	--	--

Notes: All Concentration units for the above Table 7b are in ug/m^3. * – ARITHMETIC MEAN *– GEOMETRIC MEAN -- no guideline or objective

[1] – 24 Hour sample collected every six days according to NAPS schedule [4] – real-time continuous monitoring [5] – $PM_{2.5}$ data corrected to remove offset and slope factors as per NAPS directive

Table 7c Manitoba Ambient Air Quality Data - **2002** Annual Pollutant Summary - Particulate Matter Monitoring (TSP)

POLLUTANT	STATION NUMBER & LOCATION	Collection Duration	% Data or # OF SAMPLES	PERCENTILE DISTRIBUTION 10%	30%	50%	70%	90%	99%	ANNUAL ARITH/GEO MEAN	MAXIMUM DATA VALUES 24-HR	# OF SAMPLES ABOVE M.D.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.A.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.T.L. 1-HR	24-HR
TOTAL SUSPENDED PARTICULATE (TSP)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	229	13	21	36	57	90	134	45 / 34	142	--	--	--	9	--	--
	7283[2*] CREIGHTON, SCHOOL	24-Hr	138	11	21	29	40	86	671	77 / 31	3601	--	--	--	8	--	--
	7284[2*] FLIN FLON, RUTH BETTS	24-Hr	121	8	13	20	31	58	97	27 / 21	102	--	--	--	0	--	--
	7285[2*] FLIN FLON, SEWAGE PLANT	24-Hr	102	8	12	16	23	36	50	19 / 16	68	--	--	--	0	--	--
	9118[2] WINNIPEG, 299 SCOTIA STREET	24-Hr	53	13	19	27	37	53	78	31 / 27	81	--	--	--	0	--	--
	9119[1,3] WINNIPEG, 65 ELLEN STREET	24-Hr	212	15	28	46	61	98	178	53 / 40	402	--	--	--	11	--	--
LEAD (Pb)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	229	0.03	0.04	0.11	0.25	0.80	1.88	0.28 / 0.12	3.17	--	--	--	0	--	--
	7283[2*] CREIGHTON, SCHOOL	24-Hr	60	0.02	0.02	0.05	0.10	0.29	1.99	0.17 / 0.07	3.39	--	--	--	0	--	--
	7284[2*] FLIN FLON, RUTH BETTS	24-Hr	39	0.02	0.05	0.11	0.20	0.37	0.40	0.15 / 0.10	0.41	--	--	--	0	--	--
	7285[2*] FLIN FLON, SEWAGE PLANT	24-Hr	21	0.02	0.06	0.08	0.12	0.25	0.49	0.12 / 0.09	0.54	--	--	--	0	--	--
SULPHATES (SO4=)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	229	0.80	1.38	2.12	3.08	5.40	8.32	2.70 / 2.10	13.08	--	--	--	--	--	--
	7283[2*] CREIGHTON, SCHOOL	24-Hr	60	0.66	0.94	1.47	2.02	2.95	7.91	1.77 / 1.36	8.32	--	--	--	--	--	--
	7284[2*] FLIN FLON, RUTH BETTS	24-Hr	39	0.88	1.22	1.87	2.24	3.05	3.36	1.85 / 1.66	3.40	--	--	--	--	--	--
	7285[2*] FLIN FLON, SEWAGE PLANT	24-Hr	21	0.88	1.43	1.66	2.27	2.97	4.09	1.90 / 1.69	4.25	--	--	--	--	--	--
NITRATES (NO3-)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	229	0.05	0.05	0.06	0.06	0.09	0.26	0.07 / 0.06	0.49	--	--	--	--	--	--
ARSENIC (As)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	229	0.003	0.008	0.017	0.041	0.116	0.293	0.044 / 0.019	0.361	--	--	--	2[6]	--	--
	7283[2*] CREIGHTON, SCHOOL	24-Hr	60	0.002	0.007	0.016	0.044	0.160	2.589	0.151 / 0.019	4.548	--	--	--	5[6]	--	--
	7284[2*] FLIN FLON, RUTH BETTS	24-Hr	39	0.001	0.014	0.020	0.037	0.089	0.196	0.037 / 0.016	0.220	--	--	--	0[6]	--	--
	7285[2*] FLIN FLON, SEWAGE PLANT	24-Hr	21	0.001	0.005	0.014	0.021	0.031	0.252	0.031 / 0.010	0.282	--	--	--	0[6]	--	--
CADMIUM (Cd)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	229	0.003	0.004	0.010	0.036	0.099	0.514	0.046 / 0.014	0.642	--	--	--	0[6]	--	--
	7283[2*] CREIGHTON, SCHOOL	24-Hr	60	0.003	0.003	0.003	0.003	0.012	0.032	0.005 / 0.004	0.041	--	--	--	0[6]	--	--
	7284[2*] FLIN FLON, RUTH BETTS	24-Hr	39	0.003	0.003	0.005	0.020	0.045	0.115	0.019 / 0.009	0.145	--	--	--	0[6]	--	--
	7285[2*] FLIN FLON, SEWAGE PLANT	24-Hr	21	0.003	0.005	0.005	0.018	0.078	0.126	0.023 / 0.010	0.132	--	--	--	0[6]	--	--
COPPER (Cu)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	229	0.110	0.307	0.538	1.069	2.240	5.498	0.969 / 0.533	6.201	--	--	--	0[6]	--	--
	7283[2*] CREIGHTON, SCHOOL	24-Hr	60	0.199	0.312	0.430	0.542	0.796	3.893	0.560 / 0.417	3.967	--	--	--	0[6]	--	--
	7284[2*] FLIN FLON, RUTH BETTS	24-Hr	39	0.220	0.358	0.665	0.748	1.420	1.795	0.688 / 0.550	1.904	--	--	--	0[6]	--	--
	7285[2*] FLIN FLON, SEWAGE PLANT	24-Hr	21	0.215	0.445	0.620	0.678	1.181	1.720	0.639 / 0.486	1.781	--	--	--	0[6]	--	--
ZINC (Zn)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	229	0.460	1.054	1.60	2.506	4.716	9.405	2.284 / 1.584	14.460	--	--	--	0[6]	--	--
	7283[2*] CREIGHTON, SCHOOL	24-Hr	60	0.006	0.051	0.151	0.468	1.304	10.805	0.773 / 0.121	19.204	--	--	--	0[6]	--	--
	7284[2*] FLIN FLON, RUTH BETTS	24-Hr	39	0.006	0.233	0.621	1.164	1.770	3.859	0.851 / 0.345	4.619	--	--	--	0[6]	--	--
	7285[2*] FLIN FLON, SEWAGE PLANT	24-Hr	21	0.085	0.229	0.402	0.746	1.684	2.148	0.602 / 0.300	2.259	--	--	--	0[6]	--	--

Notes: All Concentration units for the above Table 4b are in ug/m^3 -- no guideline or objective * company supplied data [1] - 24 Hour sample collected every six days according to NAPS schedule
[2] - 24 Hour sample collected every three days, synchronized with the NAPS schedule [3] - 3 additional samples collected every NAPS cycle [6] - Ontario 24-hour Guideline

Table 8 VOC Concentrations ($\mu g/m^3$) at Station 9119, 65 Ellen Street, Winnipeg from January 1 to December 31, **2000**.

Compounds	Number of Samples	Arithmetic Mean	Standard Deviation	Median	Maximum	Minimum
Ethane	55	3.35	1.90	2.62	9.89	1.07
Ethylene	55	2.57	1.39	2.14	8.23	0.77
Acetylene	55	3.15	1.65	2.68	9.54	0.98
Propylene	55	0.92	0.39	0.80	2.01	0.36
Propane	55	3.73	2.39	2.72	12.31	0.81
1-Propyne	55	0.12	0.05	0.10	0.27	0.00
Isobutane	55	2.16	2.08	1.70	14.72	0.38
1-Butene/Isobutene	55	0.63	0.23	0.54	1.22	0.30
1,3-Butadiene	55	0.21	0.08	0.19	0.41	0.07
Butane	55	3.82	2.43	3.17	11.05	0.75
trans-2-Butene	55	0.16	0.07	0.15	0.37	0.06
2,2-Dimethylpropane	55	0.05	0.02	0.05	0.11	0.03
1-Butyne	55	0.03	0.01	0.03	0.04	0.00
cis-2-Butene	55	0.15	0.06	0.13	0.31	0.07
Isopentane	55	4.95	9.34	3.08	71.72	1.19
1-Pentene	55	0.17	0.05	0.15	0.29	0.08
2-Methyl-1-butene	55	0.28	0.14	0.24	0.62	0.09
Pentane	55	1.63	1.10	1.35	8.01	0.51
Isoprene	55	0.36	0.55	0.17	2.46	0.07
trans-2-Pentene	55	0.22	0.09	0.19	0.42	0.08
cis-2-Pentene	55	0.18	0.06	0.17	0.33	0.09
2-Methyl-2-butene	55	0.40	0.17	0.35	0.81	0.15
2,2-Dimethylbutane	55	0.27	0.10	0.25	0.48	0.13
Cyclopentene	55	0.07	0.02	0.06	0.13	0.04
4-Methyl-1-pentene	55	0.04	0.02	0.04	0.08	0.00
3-Methyl-1-pentene	55	0.04	0.02	0.04	0.08	0.00
Cyclopentane	55	0.28	0.15	0.25	0.73	0.09
2,3-Dimethylbutane	55	0.38	0.18	0.32	0.99	0.15
trans-4-Methyl-2-pentene	55	0.00	0.00	0.00	0.02	0.00
2-Methylpentane	55	1.36	0.68	1.20	3.48	0.45
cis-4-Methyl-2-pentene	55	0.00	0.01	0.00	0.04	0.00
3-Methylpentane	55	0.87	0.47	0.77	2.63	0.31
1-Hexene	55	0.22	0.06	0.21	0.45	0.13
Hexane	55	0.88	0.52	0.73	3.10	0.31
trans-2-Hexene	55	0.07	0.03	0.06	0.17	0.03
2-Ethyl-1-Butene	55	0.04	0.02	0.04	0.09	0.01
trans-3-Methyl-2-pentene	55	0.06	0.03	0.05	0.16	0.00
cis-2-Hexene	55	0.06	0.03	0.05	0.11	0.00
cis-3-Methyl-2-pentene	55	0.07	0.03	0.07	0.13	0.02
2,2-Dimethylpentane	55	0.07	0.06	0.06	0.49	0.03
Methylcyclopentane	55	0.61	0.30	0.53	1.89	0.23
2,4-Dimethylpentane	55	0.26	0.13	0.21	0.85	0.10
2,2,3-Trimethylbutane	55	0.01	0.02	0.00	0.10	0.00
1-Methylcyclopentene	55	0.09	0.03	0.08	0.18	0.05
Benzene	55	1.05	0.39	0.98	2.01	0.37

Table 8 VOC Concentrations ($\mu g/m^3$) at Station 9119, 65 Ellen Street, Winnipeg from January 1 to December 31, 2000.

Compounds	Number of Samples	Arithmetic Mean	Standard Deviation	Median	Maximum	Minimum
Cyclohexane	55	0.25	0.47	0.16	3.58	0.07
2-Methylhexane	55	0.57	0.50	0.44	3.74	0.18
2,3-Dimethylpentane	55	0.54	0.32	0.44	2.25	0.21
Cyclohexene	55	0.05	0.01	0.05	0.08	0.00
3-Methylhexane	55	0.69	0.71	0.51	5.42	0.21
1-Heptene	55	0.18	0.13	0.16	1.00	0.08
2,2,4-Trimethylpentane	55	0.60	0.27	0.52	1.54	0.23
trans-3-Heptene	55	0.01	0.01	0.01	0.03	0.00
Heptane	55	0.59	0.52	0.49	3.78	0.21
trans-2-Heptene	55	0.04	0.01	0.04	0.08	0.00
cis-2-Heptene	55	0.05	0.02	0.05	0.10	0.02
2,2-Dimethylhexane	55	0.04	0.02	0.03	0.15	0.00
Methylcyclohexane	55	0.37	0.39	0.27	2.18	0.10
2,5-Dimethylhexane	55	0.10	0.04	0.08	0.28	0.04
2,4-Dimethylhexane	55	0.14	0.06	0.12	0.40	0.06
2,3,4-Trimethylpentane	55	0.19	0.08	0.16	0.43	0.07
Toluene	55	22.05	117.41	4.32	873.94	1.12
2-Methylheptane	55	0.25	0.19	0.19	1.34	0.08
1-Methylcyclohexene	55	0.06	0.01	0.06	0.09	0.03
4-Methylheptane	55	0.10	0.07	0.09	0.46	0.04
3-Methylheptane	55	0.22	0.15	0.18	1.09	0.06
cis-1,3-Dimethylcyclohexane	55	0.12	0.20	0.07	1.44	0.03
trans-1,4-Dimethylcyclohexane	55	0.05	0.08	0.04	0.55	0.02
2,2,5-Trimethylhexane	55	0.04	0.02	0.04	0.13	0.02
1-Octene	55	0.04	0.01	0.04	0.11	0.00
Octane	55	0.36	1.11	0.18	8.38	0.09
trans-1,2-Dimethylcyclohexane	55	0.10	0.28	0.05	2.13	0.00
cis-1,4/t-1,3-Dimethylcyclohexane	55	0.05	0.08	0.04	0.60	0.02
cis-1,2-Dimethylcyclohexane	55	0.06	0.11	0.04	0.86	0.03
Ethylbenzene	55	1.11	2.18	0.70	16.32	0.29
m and p-Xylene	55	3.28	4.19	2.37	30.18	0.87
Styrene	55	0.35	0.54	0.17	3.75	0.04
o-Xylene	55	1.02	0.80	0.82	5.14	0.26
1-Nonene	55	0.13	0.58	0.05	4.35	0.00
Nonane	55	1.94	12.82	0.19	95.28	0.08
iso-Propylbenzene	55	0.10	0.32	0.06	2.41	0.03
3,6-Dimethyloctane	55	0.34	2.28	0.03	16.98	0.02
n-Propylbenzene	55	0.24	0.62	0.15	4.72	0.07
3-Ethyltoluene	55	0.60	0.87	0.46	6.75	0.18
4-Ethyltoluene	55	0.32	0.39	0.26	3.07	0.11
1,3,5-Trimethylbenzene	55	0.33	0.53	0.25	4.12	0.07
2-Ethyltoluene	55	0.25	0.38	0.19	2.91	0.08
1-Decene	55	0.28	1.65	0.06	12.32	0.00
tert-Butylbenzene	55	0.02	0.04	0.02	0.28	0.00
1,2,4-Trimethylbenzene	55	0.93	0.96	0.81	7.32	0.25

Table 8 VOC Concentrations ($\mu g/m^3$) at Station 9119, 65 Ellen Street, Winnipeg from January 1 to December 31, 2000.

Compounds	Number of Samples	Arithmetic Mean	Standard Deviation	Median	Maximum	Minimum
Decane	55	1.23	6.96	0.25	51.90	0.09
iso-Butylbenzene	55	0.05	0.10	0.03	0.77	0.02
sec-Butylbenzene	55	0.07	0.24	0.03	1.81	0.02
1,2,3-Trimethylbenzene	55	0.26	0.32	0.21	2.45	0.06
p-Cymene	55	0.10	0.19	0.06	1.40	0.00
Indane	55	0.12	0.07	0.10	0.43	0.04
1,3-Diethylbenzene	55	0.07	0.06	0.06	0.46	0.02
1,4-Diethylbenzene	55	0.22	0.23	0.17	1.60	0.03
n-Butylbenzene	55	0.07	0.10	0.06	0.80	0.02
1,2-Diethylbenzene	55	0.04	0.03	0.03	0.27	0.01
Undecane	55	0.30	0.79	0.17	6.02	0.03
Dodecane	55	0.11	0.14	0.09	1.07	0.01
Hexylbenzene	40	0.15	0.22	0.07	0.80	0.01
Freon22	55	0.88	0.86	0.71	6.74	0.56
Chloromethane	55	1.14	0.12	1.18	1.38	0.86
Freon114	55	0.23	0.03	0.23	0.30	0.18
Freon113	55	0.67	0.10	0.66	0.94	0.40
Vinylchloride	55	0.02	0.01	0.02	0.05	0.01
Bromomethane	55	0.15	0.02	0.15	0.21	0.11
Chloroethane	55	0.08	0.02	0.08	0.12	0.05
Freon11	55	1.82	0.24	1.79	2.44	1.41
Freon12	55	2.86	0.34	2.85	3.89	2.15
Ethylbromide	55	0.02	0.01	0.03	0.05	0.00
1,1-Dichloroethylene	55	0.06	0.01	0.06	0.14	0.05
Dichloromethane	55	1.43	1.75	0.81	10.10	0.22
trans-1,2-Dichloroethylene	55	0.03	0.01	0.03	0.04	0.00
1,1-Dichloroethane	55	0.04	0.01	0.04	0.05	0.02
cis-1,2-Dichloroethylene	55	0.04	0.01	0.04	0.05	0.02
Chloroform	55	0.15	0.04	0.14	0.36	0.09
1,2-Dichloroethane	55	0.08	0.01	0.08	0.10	0.04
1,1,1-Trichloroethane	55	0.38	0.36	0.34	2.91	0.14
Carbontetrachloride	55	0.69	0.10	0.68	0.88	0.28
Dibromomethane	55	0.11	0.01	0.11	0.14	0.08
1,2-Dichloropropane	55	0.04	0.01	0.04	0.06	0.00
Bromodichloromethane	55	0.10	0.02	0.10	0.15	0.06
Trichloroethylene	55	0.32	0.31	0.26	2.19	0.07
cis-1,3-Dichloropropene	55	0.00	0.00	0.00	0.01	0.00
trans-1,3-Dichloropropene	55	0.01	0.01	0.01	0.02	0.00
1,1,2-Trichloroethane	55	0.04	0.01	0.04	0.07	0.03
Dibromochloromethane	55	0.06	0.01	0.06	0.09	0.04
EDB	55	0.06	0.01	0.06	0.09	0.04
Tetrachloroethylene	55	0.56	0.71	0.34	4.96	0.13
Benzylchloride	55	0.05	0.02	0.05	0.21	0.03
Chlorobenzene	55	0.00	0.00	0.00	0.00	0.00
Bromoform	55	0.06	0.01	0.06	0.08	0.04

Table 8 VOC Concentrations ($\mu g/m^3$) at Station 9119, 65 Ellen Street, Winnipeg from January 1 to December 31, **2000**.

Compounds	Number of Samples	Arithmetic Mean	Standard Deviation	Median	Maximum	Minimum
1,4-Dichlorobutane	55	0.00	0.01	0.00	0.06	0.00
1,1,2,2-Tetrachloroethane	55	0.06	0.01	0.06	0.13	0.04
1,3-Dichlorobenzene	55	0.00	0.00	0.00	0.00	0.00
1,4-Dichlorobenzene	55	0.12	0.06	0.10	0.50	0.06
1,2-Dichlorobenzene	55	0.00	0.00	0.00	0.00	0.00
1,2,4-Trichlorobenzene	55	0.00	0.00	0.00	0.00	0.00
Hexachlorobutadiene	55	0.00	0.00	0.00	0.00	0.00

The average detection limit varies between 0.5 and 1 $\mu g/m^3$.

Table 9 VOC Concentrations ($\mu g/m^3$) at Station 9119, 65 Ellen Street, Winnipeg from January 1 to December 31, **2001**.

Compounds	Number of Samples	Arithmetic Mean	Standard Deviation	Median	Maximum	Minimum
Ethane	49	3.21	1.35	3.22	6.97	1.36
Ethylene	49	2.53	1.15	2.30	5.51	0.83
Acetylene	49	2.75	1.67	2.44	7.81	0.46
Propylene	49	0.96	0.45	0.89	2.22	0.30
Propane	49	3.68	1.80	3.23	7.53	1.45
1-Propyne	49	0.13	0.06	0.12	0.29	0.03
Isobutane	49	2.16	1.45	1.85	9.38	0.43
1-Butene/Isobutene	49	0.61	0.24	0.55	1.56	0.27
1,3-Butadiene	49	0.21	0.10	0.20	0.50	0.07
Butane	49	4.07	2.55	3.55	15.83	0.66
trans-2-Butene	49	0.19	0.13	0.15	0.85	0.05
2,2-Dimethylpropane	49	0.05	0.01	0.05	0.09	0.02
1-Butyne	49	0.02	0.01	0.02	0.04	0.00
cis-2-Butene	49	0.17	0.11	0.14	0.73	0.06
Isopentane	49	4.02	2.31	3.43	14.12	1.02
1-Pentene	49	0.19	0.09	0.16	0.57	0.10
2-Methyl-1-butene	49	0.31	0.16	0.27	0.96	0.10
3-Methyl-1-butene	37	0.07	0.03	0.06	0.20	0.03
Pentane	49	1.56	0.89	1.31	5.67	0.49
Isoprene	49	0.34	0.42	0.18	2.20	0.07
trans-2-Pentene	49	0.22	0.13	0.19	0.79	0.07
cis-2-Pentene	49	0.15	0.08	0.14	0.48	0.05
2-Methyl-2-butene	49	0.29	0.17	0.25	0.86	0.08
2,2-Dimethylbutane	49	0.30	0.14	0.27	0.81	0.12
Cyclopentene	49	0.08	0.04	0.07	0.25	0.04
4-Methyl-1-pentene	49	0.04	0.02	0.04	0.08	0.00
3-Methyl-1-pentene	49	0.04	0.01	0.04	0.07	0.00
Cyclopentane	49	0.27	0.17	0.22	0.99	0.09
2,3-Dimethylbutane	49	0.34	0.17	0.29	0.86	0.12
trans-4-Methyl-2-pentene	49	0.00	0.01	0.00	0.02	0.00

Table 9 VOC Concentrations (µg/m^3) at Station 9119, 65 Ellen Street, Winnipeg from January 1 to December 31, **2001**.

Compounds	Number of Samples	Arithmetic Mean	Standard Deviation	Median	Maximum	Minimum
2-Methylpentane	49	1.36	0.67	1.16	3.80	0.55
cis-4-Methyl-2-pentene	49	0.00	0.01	0.00	0.08	0.00
3-Methylpentane	49	0.93	0.46	0.79	2.41	0.39
1-Hexene	49	0.18	0.06	0.16	0.37	0.09
Hexane	49	0.90	0.46	0.81	2.30	0.34
trans-2-Hexene	49	0.07	0.04	0.06	0.20	0.03
2-Ethyl-1-Butene	49	0.12	0.09	0.10	0.44	0.02
trans-3-Methyl-2-pentene	49	0.06	0.03	0.05	0.18	0.00
cis-2-Hexene	49	0.05	0.03	0.05	0.15	0.02
cis-3-Methyl-2-pentene	49	0.06	0.03	0.05	0.16	0.02
2,2-Dimethylpentane	49	0.06	0.02	0.05	0.11	0.02
Methylcyclopentane	49	0.63	0.36	0.51	1.79	0.19
2,4-Dimethylpentane	49	0.23	0.11	0.21	0.53	0.06
2,2,3-Trimethylbutane	49	0.01	0.01	0.01	0.03	0.00
1-Methylcyclopentene	49	0.11	0.06	0.09	0.32	0.05
Benzene	49	1.08	0.46	0.99	2.36	0.26
Cyclohexane	49	0.20	0.11	0.17	0.51	0.06
2-Methylhexane	49	0.50	0.26	0.44	1.17	0.16
2,3-Dimethylpentane	49	0.48	0.22	0.44	1.08	0.15
Cyclohexene	49	0.05	0.01	0.05	0.08	0.03
3-Methylhexane	49	0.57	0.29	0.51	1.33	0.17
1-Heptene	49	0.15	0.08	0.13	0.35	0.05
2,2,4-Trimethylpentane	49	0.56	0.27	0.51	1.50	0.16
trans-3-Heptene	49	0.03	0.02	0.02	0.07	0.00
Heptane	49	0.50	0.23	0.48	1.04	0.16
trans-2-Heptene	49	0.03	0.01	0.02	0.07	0.00
cis-2-Heptene	49	0.04	0.01	0.04	0.10	0.02
2,2-Dimethylhexane	49	0.03	0.01	0.03	0.05	0.01
Methylcyclohexane	49	0.30	0.17	0.27	0.70	0.08
2,5-Dimethylhexane	49	0.08	0.04	0.07	0.19	0.03
2,4-Dimethylhexane	49	0.12	0.05	0.11	0.27	0.04
2,3,4-Trimethylpentane	49	0.17	0.08	0.15	0.38	0.05
Toluene	49	4.93	2.94	4.49	14.66	1.10
2-Methylheptane	49	0.20	0.09	0.18	0.39	0.06
1-Methylcyclohexene	49	0.06	0.02	0.06	0.10	0.03
4-Methylheptane	49	0.08	0.04	0.08	0.17	0.02
3-Methylheptane	49	0.19	0.09	0.16	0.40	0.05
cis-1,3-Dimethylcyclohexane	49	0.09	0.07	0.08	0.47	0.03
trans-1,4-Dimethylcyclohexane	49	0.04	0.03	0.04	0.17	0.01
2,2,5-Trimethylhexane	49	0.03	0.02	0.03	0.08	0.01
1-Octene	49	0.03	0.01	0.03	0.05	0.02
Octane	49	0.18	0.08	0.17	0.43	0.07
trans-1,2-Dimethylcyclohexane	49	0.06	0.05	0.05	0.36	0.01
cis-1,4/t-1,3-Dimethylcyclohexane	49	0.04	0.04	0.04	0.27	0.01
cis-1,2-Dimethylcyclohexane	49	0.05	0.02	0.04	0.18	0.03

Table 9 VOC Concentrations ($\mu g/m^3$) at Station 9119, 65 Ellen Street, Winnipeg from January 1 to December 31, 2001.

Compounds	Number of Samples	Arithmetic Mean	Standard Deviation	Median	Maximum	Minimum
Ethylbenzene	49	0.74	0.42	0.62	2.30	0.19
m and p-Xylene	49	2.50	1.50	2.13	8.01	0.58
Styrene	49	0.34	0.60	0.16	4.06	0.03
o-Xylene	49	0.80	0.43	0.73	2.21	0.20
1-Nonene	49	0.04	0.02	0.04	0.12	0.00
Nonane	49	0.20	0.12	0.17	0.69	0.07
iso-Propylbenzene	49	0.06	0.03	0.06	0.14	0.03
3,6-Dimethyloctane	49	0.03	0.01	0.03	0.08	0.01
n-Propylbenzene	49	0.18	0.12	0.14	0.55	0.06
3-Ethyltoluene	49	0.56	0.39	0.42	1.81	0.13
4-Ethyltoluene	49	0.30	0.19	0.24	0.90	0.09
1,3,5-Trimethylbenzene	49	0.30	0.20	0.23	0.92	0.04
2-Ethyltoluene	49	0.22	0.14	0.18	0.67	0.07
1-Decene	49	0.04	0.03	0.04	0.10	0.00
tert-Butylbenzene	49	0.02	0.01	0.02	0.04	0.00
1,2,4-Trimethylbenzene	49	0.87	0.58	0.66	2.67	0.14
Decane	49	0.28	0.17	0.24	0.81	0.06
iso-Butylbenzene	49	0.03	0.01	0.03	0.06	0.02
sec-Butylbenzene	49	0.04	0.01	0.04	0.07	0.02
1,2,3-Trimethylbenzene	49	0.22	0.12	0.18	0.60	0.05
p-Cymene	49	0.07	0.04	0.06	0.27	0.02
Indane	49	0.12	0.06	0.10	0.31	0.04
1-Undecene	37	0.01	0.02	0.00	0.06	0.00
1,3-Diethylbenzene	49	0.06	0.03	0.06	0.15	0.03
1,4-Diethylbenzene	49	0.17	0.10	0.14	0.51	0.06
n-Butylbenzene	49	0.06	0.02	0.05	0.13	0.02
1,2-Diethylbenzene	49	0.03	0.01	0.03	0.06	0.02
Undecane	49	0.19	0.09	0.17	0.52	0.04
Naphthalene	21	0.35	0.58	0.00	1.62	0.00
Dodecane	49	0.12	0.06	0.11	0.30	0.04
Hexylbenzene	49	0.16	0.08	0.14	0.36	0.04
Freon22	49	0.89	0.41	0.74	2.95	0.60
Chloromethane	49	1.10	0.07	1.11	1.29	0.98
Freon114	49	0.21	0.02	0.22	0.26	0.16
Freon113	49	0.72	0.05	0.72	0.88	0.58
Vinylchloride	49	0.02	0.01	0.02	0.03	0.00
Bromomethane	49	0.14	0.02	0.14	0.18	0.09
Chloroethane	49	0.06	0.01	0.06	0.09	0.03
Freon11	49	1.66	0.12	1.65	2.15	1.45
Freon12	49	2.82	0.20	2.81	3.35	2.36
Ethylbromide	49	0.03	0.01	0.03	0.04	0.00
1,1-Dichloroethylene	49	0.06	0.02	0.06	0.09	0.02
Dichloromethane	49	1.72	2.98	0.90	20.02	0.22
trans-1,2-Dichloroethylene	49	0.03	0.01	0.03	0.04	0.02
1,1-Dichloroethane	49	0.03	0.01	0.03	0.05	0.00

Table 9 VOC Concentrations (µg/m^3) at Station 9119, 65 Ellen Street, Winnipeg from January 1 to December 31, 2001.

Compounds	Number of Samples	Arithmetic Mean	Standard Deviation	Median	Maximum	Minimum
cis-1,2-Dichloroethylene	49	0.03	0.01	0.04	0.07	0.02
Chloroform	49	0.14	0.02	0.13	0.22	0.11
1,2-Dichloroethane	49	0.08	0.01	0.07	0.11	0.06
1,1,1-Trichloroethane	49	0.26	0.02	0.25	0.31	0.22
Carbontetrachloride	49	0.64	0.04	0.63	0.80	0.58
Dibromomethane	49	0.10	0.02	0.10	0.12	0.06
1,2-Dichloropropane	49	0.04	0.01	0.03	0.07	0.02
Bromodichloromethane	49	0.09	0.02	0.10	0.16	0.05
Trichloroethylene	49	0.29	0.17	0.23	0.81	0.07
cis-1,3-Dichloropropene	49	0.00	0.00	0.00	0.01	0.00
trans-1,3-Dichloropropene	49	0.01	0.01	0.02	0.03	0.00
1,1,2-Trichloroethane	49	0.04	0.01	0.04	0.06	0.00
Bromotrichloromethane	3	0.00	0.00	0.00	0.00	0.00
Dibromochloromethane	49	0.05	0.02	0.06	0.09	0.03
EDB	49	0.05	0.02	0.06	0.08	0.02
Tetrachloroethylene	49	0.51	0.51	0.35	2.75	0.11
Benzylchloride	49	0.04	0.01	0.05	0.06	0.02
Chlorobenzene	49	0.00	0.00	0.00	0.00	0.00
Bromoform	49	0.05	0.01	0.05	0.07	0.03
1,4-Dichlorobutane	49	0.00	0.01	0.00	0.04	0.00
1,1,2,2-Tetrachloroethane	49	0.05	0.02	0.06	0.07	0.02
1,3-Dichlorobenzene	49	0.04	0.02	0.05	0.07	0.00
1,4-Dichlorobenzene	49	0.12	0.03	0.11	0.23	0.05
1,2-Dichlorobenzene	49	0.05	0.02	0.05	0.08	0.00
1,2,4-Trichlorobenzene	49	0.09	0.04	0.09	0.15	0.00
Hexachlorobutadiene	49	0.05	0.35	0.00	2.47	0.00

The average detection limit varies between 0.5 and 1 µg/m^3.

Table 10 VOC Concentrations ($\mu g/m^3$) at Station 9119, 65 Ellen Street, Winnipeg from January 1 to December 31, 2002.

Compounds	Number of Samples	Arithmetic Mean	Standard Deviation	Median	Maximum	Minimum
Ethane	58	2.74	1.46	2.49	9.86	0.68
Ethylene	58	2.48	1.40	2.12	8.92	1.21
Acetylene	58	1.73	0.97	1.48	6.60	0.71
Propylene	58	0.95	0.54	0.81	3.39	0.41
Propane	58	2.94	3.17	2.32	24.26	0.68
1-Propyne	58	0.12	0.06	0.11	0.45	0.05
Isobutane	58	1.79	1.14	1.48	6.98	0.51
1-Butene/Isobutene	58	0.59	0.26	0.55	1.87	0.26
1,3-Butadiene	58	0.20	0.10	0.18	0.73	0.09
Butane	58	4.02	2.39	3.23	12.77	1.23
trans-2-Butene	58	0.16	0.08	0.13	0.44	0.06
2,2-Dimethylpropane	58	0.04	0.02	0.04	0.11	0.01
1-Butyne	58	0.02	0.01	0.02	0.05	0.00
cis-2-Butene	58	0.15	0.07	0.13	0.40	0.05
Isopentane	58	3.88	2.05	3.33	11.12	1.43
1-Pentene	58	0.19	0.09	0.17	0.63	0.06
2-Methyl-1-butene	56	0.39	0.23	0.33	1.57	0.12
3-Methyl-1-butene	58	0.06	0.03	0.06	0.16	0.02
Pentane	58	1.34	0.60	1.20	3.46	0.55
Isoprene	58	0.32	0.40	0.15	1.76	0.06
trans-2-Pentene	58	0.22	0.12	0.20	0.61	0.07
cis-2-Pentene	58	0.14	0.07	0.13	0.40	0.05
2-Methyl-2-butene	58	0.28	0.14	0.25	0.72	0.10
2,2-Dimethylbutane	58	0.29	0.14	0.27	0.77	0.08
Cyclopentene	58	0.08	0.03	0.07	0.14	0.02
4-Methyl-1-pentene	58	0.03	0.02	0.03	0.12	0.01
3-Methyl-1-pentene	58	0.03	0.01	0.03	0.06	0.00
Cyclopentane	58	0.22	0.09	0.20	0.46	0.08
2,3-Dimethylbutane	58	0.32	0.14	0.29	0.62	0.09
trans-4-Methyl-2-pentene	58	0.02	0.01	0.02	0.04	0.00
2-Methylpentane	52	1.35	0.55	1.26	2.92	0.47
cis-4-Methyl-2-pentene	57	0.05	0.02	0.05	0.10	0.00
3-Methylpentane	46	0.78	0.49	0.76	2.42	0.00
1-Hexene	49	0.13	0.09	0.14	0.45	0.00
Hexane	41	0.73	0.43	0.54	2.35	0.28
trans-2-Hexene	58	0.06	0.03	0.05	0.21	0.02
2-Ethyl-1-Butene	58	0.13	0.07	0.11	0.52	0.05
trans-3-Methyl-2-pentene	58	0.04	0.02	0.04	0.15	0.00
cis-2-Hexene	58	0.04	0.02	0.03	0.14	0.00
cis-3-Methyl-2-pentene	58	0.04	0.02	0.04	0.16	0.01
2,2-Dimethylpentane	58	0.04	0.02	0.04	0.14	0.02
Methylcyclopentane	58	0.48	0.35	0.38	2.18	0.16
2,4-Dimethylpentane	58	0.21	0.12	0.18	0.84	0.09
2,2,3-Trimethylbutane	58	0.01	0.01	0.01	0.08	0.00
1-Methylcyclopentene	58	0.07	0.04	0.07	0.31	0.02

Table 10 VOC Concentrations ($\mu g/m^3$) at Station 9119, 65 Ellen Street, Winnipeg from January 1 to December 31, 2002.

Compounds	Number of Samples	Arithmetic Mean	Standard Deviation	Median	Maximum	Minimum
Benzene	58	1.03	0.48	0.95	3.74	0.45
Cyclohexane	58	0.15	0.08	0.14	0.57	0.05
2-Methylhexane	58	0.46	0.26	0.41	1.66	0.17
2,3-Dimethylpentane	58	0.47	0.27	0.41	1.86	0.18
Cyclohexene	58	0.04	0.03	0.04	0.23	0.00
3-Methylhexane	58	0.49	0.29	0.41	1.88	0.15
1-Heptene	58	0.02	0.06	0.00	0.34	0.00
2,2,4-Trimethylpentane	58	0.49	0.33	0.40	2.21	0.16
trans-3-Heptene	58	0.03	0.01	0.02	0.09	0.01
cis-3-Heptene	57	0.11	0.09	0.09	0.67	0.00
Heptane	58	0.37	0.24	0.31	1.53	0.08
trans-2-Heptene	58	0.02	0.01	0.02	0.07	0.00
cis-2-Heptene	58	0.02	0.01	0.02	0.07	0.00
.2-Dimethylhexane	58	0.02	0.01	0.02	0.08	0.00
.ethylcyclohexane	58	0.20	0.16	0.16	0.98	0.05
2,5-Dimethylhexane	58	0.06	0.04	0.05	0.27	0.02
2,4-Dimethylhexane	58	0.09	0.06	0.07	0.39	0.02
2,3,4-Trimethylpentane	58	0.14	0.10	0.12	0.66	0.05
Toluene	58	4.94	5.11	3.41	35.07	0.89
2-Methylheptane	58	0.14	0.08	0.13	0.58	0.04
1-Methylcyclohexene	58	0.04	0.02	0.04	0.13	0.00
4-Methylheptane	58	0.05	0.03	0.05	0.21	0.00
3-Methylheptane	58	0.14	0.08	0.12	0.60	0.05
cis-1,3-Dimethylcyclohexane	58	0.06	0.04	0.05	0.27	0.02
trans-1,4-Dimethylcyclohexane	58	0.03	0.02	0.02	0.12	0.01
2,2,5-Trimethylhexane	58	0.03	0.02	0.02	0.12	0.01
1-Octene	58	0.02	0.04	0.02	0.34	0.00
Octane	58	0.13	0.08	0.11	0.54	0.04
trans-1,2-Dimethylcyclohexane	58	0.02	0.01	0.01	0.07	0.00
trans-2-Octene	57	0.04	0.03	0.03	0.18	0.00
cis-1,4/t-1,3-Dimethylcyclohexane	58	0.03	0.02	0.02	0.13	0.01
cis-1,2-Dimethylcyclohexane	58	0.03	0.01	0.03	0.10	0.01
Ethylbenzene	58	0.59	0.36	0.48	2.14	0.20
m and p-Xylene	58	2.02	1.28	1.54	7.02	0.46
Styrene	58	0.19	0.28	0.12	1.88	0.03
o-Xylene	58	0.65	0.40	0.51	2.42	0.16
1-Nonene	58	0.01	0.05	0.00	0.36	0.00
Nonane	58	0.14	0.07	0.11	0.44	0.05
iso-Propylbenzene	58	0.04	0.02	0.04	0.11	0.01
3,6-Dimethyloctane	58	0.02	0.01	0.02	0.05	0.00
n-Propylbenzene	58	0.12	0.07	0.10	0.32	0.03
3-Ethyltoluene	58	0.38	0.24	0.29	1.18	0.08
4-Ethyltoluene	58	0.21	0.13	0.16	0.62	0.03
1,3,5-Trimethylbenzene	58	0.20	0.12	0.16	0.60	0.03
2-Ethyltoluene	58	0.16	0.09	0.12	0.44	0.03

Table 10 VOC Concentrations ($\mu g/m^3$) at Station 9119, 65 Ellen Street, Winnipeg from January 1 to December 31, 2002.

Compounds	Number of Samples	Arithmetic Mean	Standard Deviation	Median	Maximum	Minimum
1-Decene	58	0.02	0.03	0.01	0.25	0.00
tert-Butylbenzene	58	0.02	0.01	0.02	0.04	0.00
1,2,4-Trimethylbenzene	58	0.60	0.37	0.45	1.79	0.10
Decane	58	0.19	0.11	0.16	0.56	0.04
iso-Butylbenzene	58	0.02	0.01	0.02	0.05	0.00
sec-Butylbenzene	58	0.02	0.01	0.02	0.05	0.00
1,2,3-Trimethylbenzene	58	0.15	0.08	0.12	0.38	0.03
p-Cymene	58	0.04	0.02	0.03	0.10	0.00
Indane	58	0.07	0.04	0.06	0.23	0.01
1-Undecene	58	0.02	0.04	0.02	0.33	0.00
1,3-Diethylbenzene	58	0.04	0.02	0.04	0.09	0.01
1,4-Diethylbenzene	58	0.12	0.06	0.10	0.25	0.02
n-Butylbenzene	58	0.04	0.02	0.03	0.08	0.01
1,2-Diethylbenzene	58	0.02	0.01	0.02	0.05	0.00
Undecane	58	0.12	0.07	0.10	0.31	0.03
Naphthalene	54	0.65	0.39	0.56	1.81	0.16
Dodecane	58	0.12	0.08	0.11	0.35	0.00
Hexylbenzene	58	0.16	0.12	0.12	0.56	0.00
Freon22	58	0.89	0.25	0.85	1.73	0.56
Chloromethane	58	1.18	0.10	1.15	1.61	1.05
Freon114	58	0.21	0.05	0.21	0.33	0.11
Freon113	58	0.75	0.10	0.74	0.91	0.57
Vinylchloride	58	0.02	0.01	0.02	0.03	0.00
Bromomethane	58	0.13	0.04	0.13	0.30	0.05
Chloroethane	58	0.06	0.03	0.06	0.16	0.00
Freon11	58	2.00	0.31	2.06	2.81	1.52
Freon12	58	3.04	0.41	3.01	4.07	2.44
Ethylbromide	58	0.02	0.01	0.03	0.05	0.00
1,1-Dichloroethylene	58	0.05	0.02	0.05	0.10	0.00
Dichloromethane	58	1.11	1.74	0.49	10.11	0.22
trans-1,2-Dichloroethylene	58	0.03	0.01	0.03	0.05	0.00
1,1-Dichloroethane	58	0.03	0.01	0.03	0.05	0.00
cis-1,2-Dichloroethylene	49	0.02	0.02	0.02	0.06	0.00
Chloroform	58	0.11	0.04	0.11	0.23	0.05
1,2-Dichloroethane	58	0.07	0.02	0.07	0.11	0.02
1,1,1-Trichloroethane	58	0.21	0.03	0.22	0.30	0.07
Carbontetrachloride	58	0.65	0.08	0.65	0.84	0.50
Dibromomethane	58	0.08	0.03	0.08	0.14	0.02
1,2-Dichloropropane	58	0.03	0.01	0.03	0.05	0.00
Bromodichloromethane	58	0.07	0.02	0.07	0.16	0.01
Trichloroethylene	58	0.20	0.17	0.14	1.00	0.03
cis-1,3-Dichloropropene	58	0.00	0.00	0.00	0.01	0.00
trans-1,3-Dichloropropene	54	0.01	0.01	0.01	0.03	0.00
1,1,2-Trichloroethane	58	0.03	0.02	0.04	0.07	0.00
Bromotrichloromethane	5	0.01	0.01	0.01	0.01	0.00

Table 10 VOC Concentrations ($\mu g/m^3$) at Station 9119, 65 Ellen Street, Winnipeg from January 1 to December 31, **2002**.

Compounds	Number of Samples	Arithmetic Mean	Standard Deviation	Median	Maximum	Minimum
Dibromochloromethane	58	0.04	0.02	0.04	0.08	0.00
EDB	58	0.04	0.02	0.04	0.08	0.00
Tetrachloroethylene	58	0.30	0.35	0.18	2.15	0.06
Benzylchloride	58	0.04	0.01	0.04	0.06	0.01
Chlorobenzene	58	0.00	0.00	0.00	0.00	0.00
Bromoform	58	0.04	0.02	0.04	0.08	0.01
1,4-Dichlorobutane	58	0.03	0.06	0.03	0.46	0.00
1,1,2,2-Tetrachloroethane	58	0.04	0.02	0.05	0.10	0.00
1,3-Dichlorobenzene	58	0.04	0.01	0.04	0.08	0.00
1,4-Dichlorobenzene	58	0.10	0.04	0.09	0.19	0.03
1,2-Dichlorobenzene	58	0.04	0.02	0.04	0.09	0.00
1,2,4-Trichlorobenzene	58	0.11	0.06	0.10	0.39	0.01
Hexachlorobutadiene	58	0.00	0.00	0.00	0.00	0.00

The average detection limit varies between 0.5 and 1 $\mu g/m^3$.

Table 11 PAH Concentrations (ng/m³) at Station 9119, 65 Ellen Street, Winnipeg from January 1, 2000 to August 24, 2002.

COMPOUNDS	Number of Samples	Arithmetic Mean	Standard Deviation	Median	Minimum Concentration	Maximum Concentration
Acenaphthylene	30	1.73857	2.27892	0.66015	0.08100	10.05000
Acenaphthene	30	0.64290	0.47078	0.57625	0.07200	1.76600
Fluorene	30	2.03782	1.17415	1.89935	0.60800	5.38740
2-Me-Fluorene	30	0.69866	0.34692	0.68850	0.00300	1.45900
Phenanthrene	30	5.41582	2.73217	5.25960	1.35400	12.22880
Anthracene	30	0.47073	0.32478	0.38100	0.07900	1.20720
Fluoranthene	30	1.51954	0.75962	1.38350	0.30400	3.29890
Pyrene	30	1.25774	0.83397	1.08050	0.25900	4.215500
Retene	19	0.17965	0.15228	0.14100	0.03500	0.57030
Benzo(a)Fluorene	30	0.09561	0.07876	0.07090	0.02400	0.31700
Benzo(b)Fluorene	30	0.04769	0.04085	0.03550	0.00300	0.16200
1-Me-Pyrene	30	0.06569	0.04520	0.05375	0.01600	0.17500
Benzo(g,h,i)Fluoranthene	30	0.18521	0.17007	0.11550	0.03400	0.77500
Benz(a)Anthracene	30	0.11562	0.14993	0.05950	0.02400	0.60000
Chrysene	30	0.20810	0.17468	0.13900	0.06400	0.69000
Triphenylene	30	0.06339	0.04508	0.04700	0.00700	0.17600
Chrysene&Triphenylene	0	-	-	-	-	-
7-Me-Benz(a)Anthracene	30	0.01039	0.00402	0.01050	0.00500	0.01820
Benzo(b)Fluoranthene	30	0.26632	0.22826	0.17150	0.05900	0.84900
Benzo(k)Fluoranthene	30	0.08494	0.07328	0.05550	0.02600	0.29700
Benzo(b)&(k)Fluoranthene	0	-	-	-	-	-
Benzo(e)Pyrene	30	0.14721	0.12544	0.09500	0.00900	0.49200
Benzo(a)Pyrene	30	0.07658	0.10163	0.04170	0.01400	0.47000
Perylene	30	0.01772	0.02019	0.01200	0.00800	0.11000
2-Me-Cholanthrene	30	0.01871	0.00583	0.02100	0.01000	0.02730
Indeno(1,2,3-cd)Pyrene	30	0.16073	0.14189	0.11060	0.03700	0.52900
Dibenz(a,c)&(a,h)Anthracene	30	0.02840	0.01806	0.02250	0.01100	0.06800
Benzo(b)Chrysene	30	0.02872	0.01804	0.02250	0.010000	0.06500
Benzo(g,h,i)Perylene	30	0.23077	0.21820	0.12800	0.06000	0.84200
Anthanthrene	30	0.02953	0.01136	0.02350	0.02000	0.05400

Note: PAH and PCDD/PCDF Sampling was temporarily suspended in the fall of 2002.

Table 12 PCDD/PCDF Concentrations (pg/m³) at Station 9119, 65 Ellen Street, Winnipeg from January1, 2000 to August 24, 2002.

Congener	Number of Samples	Mean	St. Dev.	Median	Min	Max
2378-TCDD	28	0.02189	0.001388	0.001900	0.000800	0.005000
12378-P5CDD	28	0.009222	0.005735	0.008000	0.004000	0.025000
123478-H6CDD	28	0.009506	0.007998	0.006000	0.001900	0.028000
123678-H6CDD	28	0.013260	0.013534	0.008000	0.002300	0.057000
123789-H6CDD	28	0.022396	0.022404	0.014000	0.002800	0.085000
1234678-H7CDD	28	0.146450	0.153606	0.078650	0.028300	0.637000
OCDD	28	0.407361	0.358809	0.270300	0.097400	1.634000
2378-TCDF	28	0.014496	0.011300	0.010250	0.005200	0.052000
12378-P5CDF	28	0.004606	0.004157	0.003050	0.001000	0.014700
23478-P5CDF	28	0.006526	0.006479	0.003100	0.002000	0.024200
123478-H6CDF	28	0.012700	0.014837	0.007200	0.003000	0.069400
123678-H6CDF	28	0.007230	0.007863	0.004000	0.001500	0.034100
234678-H6CDF	28	0.009029	0.010022	0.005000	0.001300	0.043800
123789-H6CDF	28	0.000000	0.000000	0.000000	0.000000	0.000000
1234678-H7CDF	28	0.031271	0.028679	0.022000	0.011000	0.147100
1234789-H7CDF	28	0.007080	0.006850	0.006000	0.001300	0.024700
OCDF	28	0.028633	0.019032	0.019200	0.010000	0.081200
TCDD	28	0.25633	0.030732	0.015000	0.003000	0.124000
P5CDD	28	0.069364	0.090985	0.038300	0.005000	0.384000
H6CDD	28	0.176169	0.189763	0.105750	0.023000	0.728000
H7CDD	28	0.298589	0.313511	0.177000	0.052800	1.320000
OCDD	28	0.407361	0.358809	0.270300	0.097400	1.634000
TOTAL PCDD	28	0.956186	0.942251	0.609000	0.202000	4.024000
TCDF	28	0.085556	0.071773	0.068000	0.015000	0.332100
P5CDF	28	0.066229	0.072777	0.044250	0.007000	0.349000
H6CDF	28	0.069164	0.091744	0.042850	0.008000	0.467400
H7CDF	28	0.051671	0.053267	0.030300	0.011000	0.256800
OCDF	28	0.517033	2.534786	0.023000	0.010000	13.200000
TOTAL PCDF	28	0.296700	0.301330	0.185250	0.062000	1.486500
TEQ	28	0.018992	0.014282	0.012079	0.003726	0.058370

Note: PAH and PCDD/PCDF Sampling was temporarily suspended in the fall of 2002.

Table 13 Aldehyde/Ketone Concentrations ($\mu g/m^3$) at Station 9119, 65 Ellen Street, Winnipeg from January 1, 2000 to December 31, 2002.

Compounds	Number of Samples	Arithmetic Mean	Standard Deviation	Median	Maximum	Minimum
Formaldehyde	149	2.65	1.118	2.51	7.42	0.64
Acetaldehyde	149	1.25	0.504	1.17	3.16	0.07
Acrolein	149	0.10	0.212	0.08	2.59	0.00
Acetone	149	3.26	1.376	3.12	9.09	0.24
Propionaldehyde	149	0.31	0.118	0.30	0.70	0.05
Crotonaldehyde	149	0.12	0.216	0.06	2.15	0.00
MEK	149	1.12	0.761	0.85	4.97	0.08
Benzaldehyde	149	0.12	0.062	0.10	0.48	0.04
2-Pentanone/Isovaleraldehyde	149	0.11	0.057	0.10	0.30	0.00
Valeraldehyde	149	0.07	0.034	0.06	0.17	0.00
o-Tolualdehyde	149	0.01	0.011	0.00	0.04	0.00
m-Tolualdehyde	149	0.03	0.023	0.03	0.13	0.00
p-Tolualdehyde	149	0.02	0.024	0.02	0.13	0.00
MIBK	149	0.13	0.120	0.10	0.64	0.00
Hexanal	149	0.10	0.060	0.08	0.27	0.00
2,5-Dimethylbenzaldehyde	149	0.00	0.002	0.00	0.02	0.00

DISCUSSION

CAUTIONARY NOTE:

Though it was the intent, within the design of the sampling network, to locate monitoring sites in accordance with generally accepted siting criteria and to use collection and analytical procedures that are common to other networks, it should be noted that the data presented in this report may have limitations and, therefore, caution should be exercised towards their use. In particular, when comparing data between Canadian regions and even between stations in the same city, it must be realized that the data represent the condition of the air in the vicinity of the individual monitoring station and may not necessarily reflect community-wide air quality.

A. WINNIPEG AIR QUALITY

Downtown

Air quality in the downtown area of Winnipeg was represented by monitoring at station #9119, 65 Ellen Street, a NAPS Class 1 site. Measurements were made for the parameters carbon monoxide (CO), nitrogen dioxide (NO_2), nitric oxide (NO), nitrogen oxides (NO_x), ground level ozone (O_3), total suspended particulate (TSP), inhalable particulates ($PM_{10 \text{ and } 2.5}$), volatile organic compounds (VOCs), polyaromatic hydrocarbons (PAHs) and aldehydes/ketones.

Air Quality Index

The Air Quality Index (Figures 6, 7 & 8, Table 14) was in the Good range for over 90% of the time (on average) in 2000, 2001 and 2002 (discounting N/A times). In 2000 and 2001, there were two hours and one hour, respectively where the Air Quality was Poor, whereas in 2002 there were 102 Poor and 47 Very Poor hours. This stretch of Poor/Very Poor Air Quality, in April, 2002, coincided with the annual street cleaning operation in the City of Winnipeg. Some additional Poor Air Quality hours occurred in the third week of July when smoke from forest fires blew into the City. In 2000 there were fewer Fair Air Quality hours than in the previous three years and the subsequent two years. In 2001 and 2002 the number of Fair hours were similar, 500 and 581 respectively. The distribution of the Fair hours was similar for the two years with the majority of hours occuring in the latter half of the first quarter and the first half of the second quarter of the year. In 2002, most of the Poor/Very Poor hours occurred during the spring and could be attributed to road dust entrainment by vehicles and wind prior to the annual street cleaning in the spring. In all three years the major influencing factor was PM (averaged over 24 hours) followed by ground-level ozone and then nitrogen dioxide (a distant third). For 2000, the $PM_{2.5}$ instrument came online in November and the number of hours attributable to 24hr-$PM_{2.5}$ was roughly equal to the number of hours attributable to 24hr-PM_{10} for the fourth quarter of 2000. In 2001, there were 8 times as many hours attributable to 24hr-$PM_{2.5}$ as there were to 24hr-PM_{10}, whereas in 2002, the number of hours attributable to 24hr-$PM_{2.5}$ was only 25% higher than the number of 24hr-PM_{10} hours.

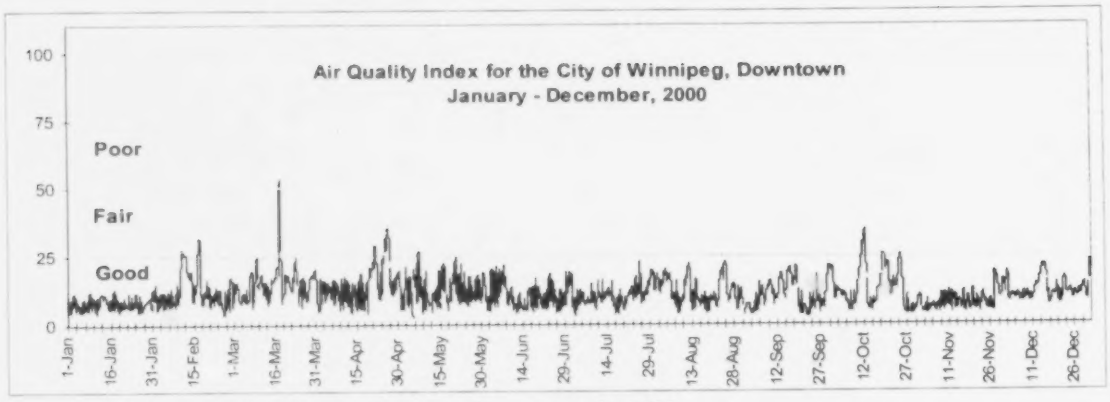

Figure 6. The Air Quality Index for Winnipeg (Downtown) for 2000.

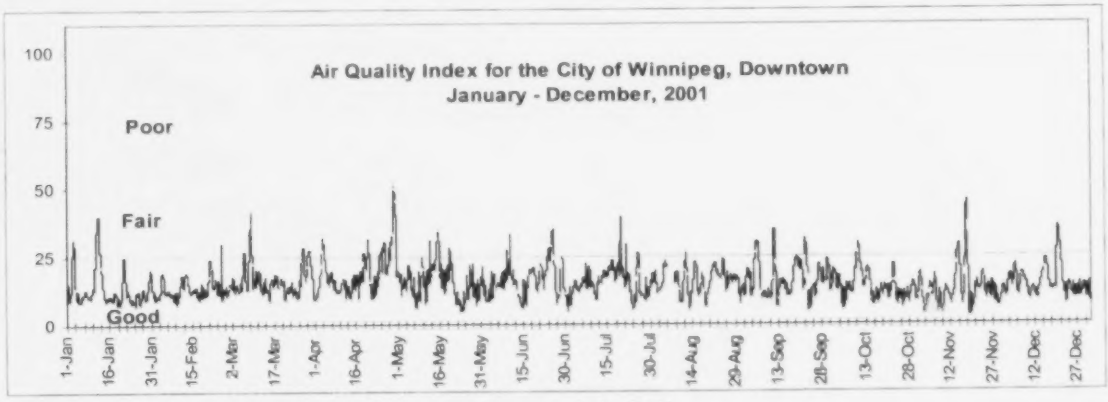

Figure 7. The Air Quality Index for Winnipeg (Downtown) for 2001.

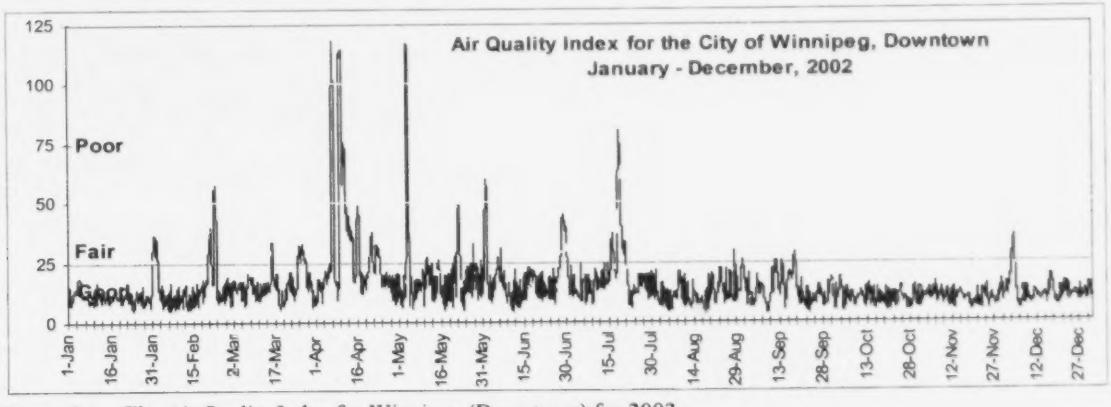

Figure 8. The Air Quality Index for Winnipeg (Downtown) for 2002.

Table 14: Summary of AQI for Winnipeg (Downtown) by Category and determining Pollutant for 2000, 2001 and 2002 (by quarters).

	Number of Hours					
2000	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total	% of available
Good	2009	2002	2095	2058	8164	98%
Fair	47	61	0	43	151	2%
Poor	2	0	0	0	2	0%
V.Poor	0	0	0	0	0	0%
N/A	126	121	113	107	467	--
Total	2184	2184	2208	2208	8784	100%
CO	1	0	0	0	1	0%
8-Hr CO	20	88	0	85	193	2%
24-Hr $PM_{2.5}$	0	0	0	712	712	8%
24-Hr PM_{10}	999	626	1583	721	3929	45%
NO_2	365	109	23	179	676	8%
O_3	673	1240	489	404	2806	32%
N/A	126	121	113	107	467	5%
Total	2184	2184	2208	2208	8784	100%

2001	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total	%
Good	1951	1854	1977	2005	7787	94%
Fair	110	225	75	90	500	6%
Poor	0	1	0	0	1	0%
V.Poor	0	0	0	0	0	0%
N/A	99	104	156	113	472	--
Total	2160	2184	2208	2208	8760	100%
CO	0	0	0	0	0	0%
8-Hr CO	0	0	14	0	14	0%
24-Hr $PM_{2.5}$	1547	1119	1712	1548	5926	68%
24-Hr PM_{10}	223	303	66	105	697	8%
NO_2	18	3	0	11	32	0%
O_3	273	655	260	431	1619	18%
N/A	99	104	156	113	472	5%
Total	2160	2184	2208	2208	8760	100%

N/A The AQI would not be available 4% of the time or 1 in every 24 hours due to the internal calibrations that occur each day at 3 a.m. CST. Additional N/A times would occur during routine instrument maintenance.

Table 14 (Continued) Summary of AQI for Winnipeg (Downtown) by Category and determining Pollutant for 2000, 2001 and 2002 (by quarters).

	Number of Hours					
2002	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total	%
Good	1882	1670	1995	2079	7626	91%
Fair	164	300	92	25	581	7%
Poor	12	64	26	0	102	1%
V.Poor	0	47	0	0	47	1%
N/A	102	103	95	104	404	--
Total	2160	2184	2208	2208	8760	100%
CO	0	0	0	0	0	0%
8-Hr CO	0	6	4	0	10	0%
24-Hr $PM_{2.5}$	735	659	535	594	2523	29%
24-Hr PM_{10}	333	424	764	551	2072	24%
NO_2	103	26	16	99	244	3%
O_3	887	966	794	860	3507	40%
N/A	102	103	95	104	404	5%
Total	2160	2184	2208	2208	8760	100%

N/A The AQI would not be available 4% of the time or 1 in every 24 hours due to the internal calibrations that occur each day at 3 a.m. CST. Additional N/A times would occur during routine instrument maintenance, instrument failure and/or repair.

Carbon Monoxide

The maximum 1-hour and the maximum 8-hour concentrations since 1978 have not exceeded the MAL. Average monthly levels of CO in the downtown area (shown in Figures 10 to 12) were slightly higher than those observed in the residential area. Yearly trends are shown in Figure 9.

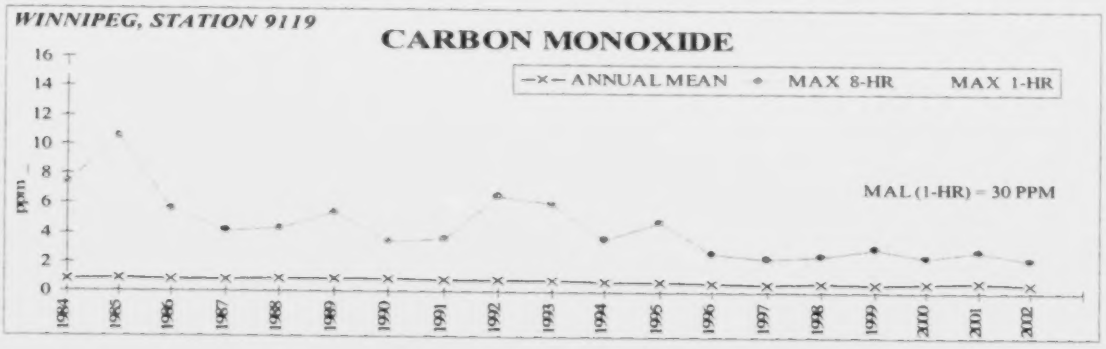

Figure 9 Annual mean, 8-Hr and 1-Hr maximum carbon monoxide levels calculated and observed for the Winnipeg downtown monitoring site.

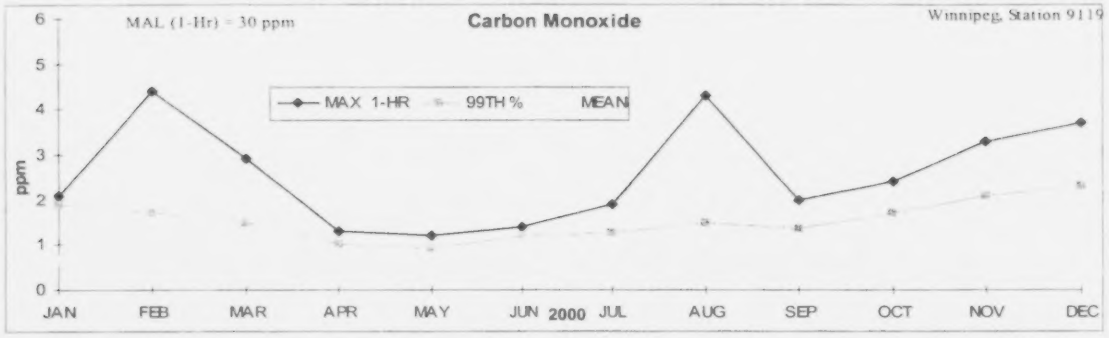

Figure 10 Monthly mean and 1-Hr maximum carbon monoxide levels calculated and observed for the Winnipeg downtown monitoring site for 2000.

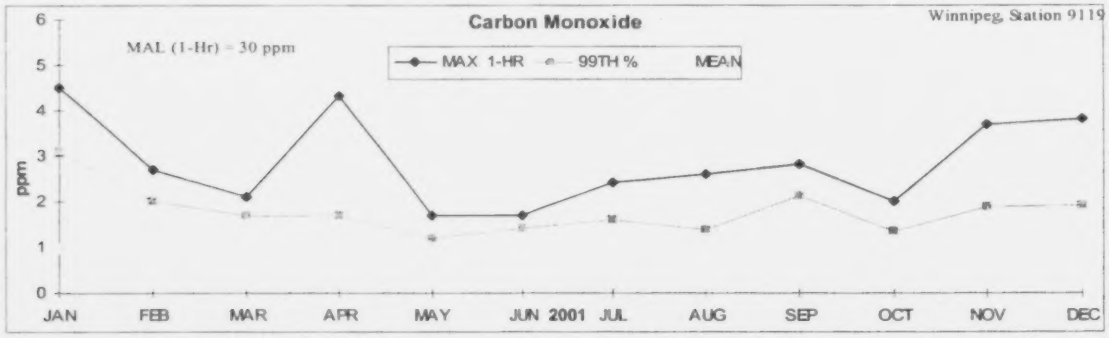

Figure 11 Monthly mean and 1-Hr maximum carbon monoxide levels calculated and observed for the Winnipeg downtown monitoring site for 2001.

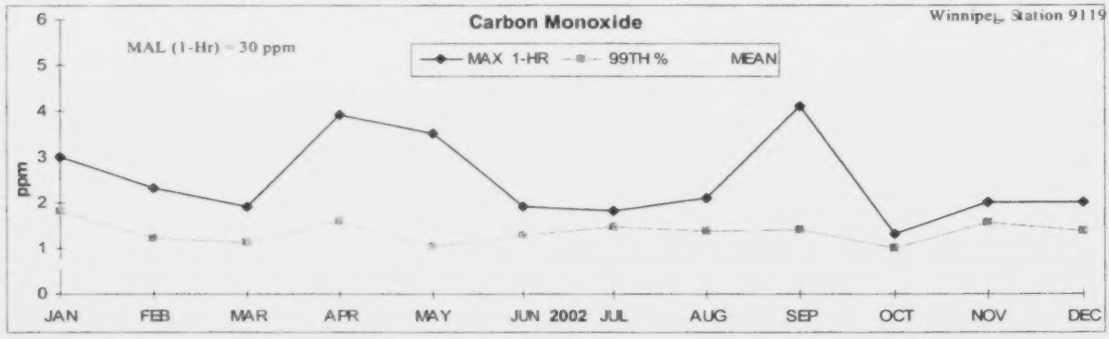

Figure 12 Monthly mean and 1-Hr maximum carbon monoxide levels calculated and observed for the Winnipeg downtown monitoring site for 2002.

Ozone

Ground level O_3 at the downtown station had the lowest annual mean, for 2000, 2001 and 2002, of the three stations monitoring ozone in Manitoba. The annual and monthly trends are shown in Figure 13 and Figures 14, 15 and 16, respectively. The 1-hour MAL of 8.2 pphm has not been exceeded since 1990.

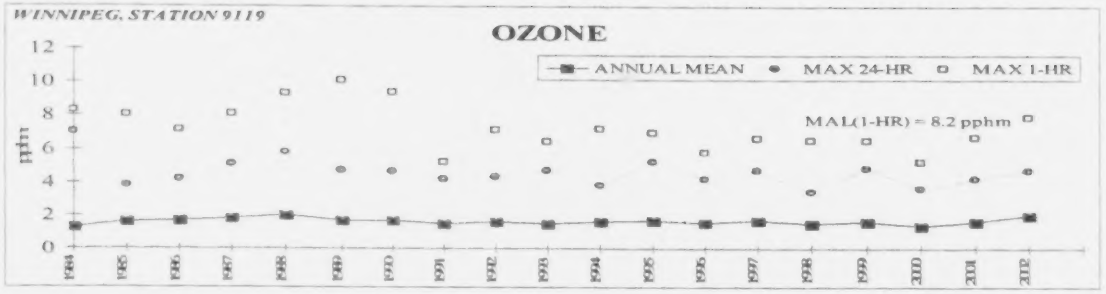

Figure 13 Annual mean, 24-Hr and 1-Hr maximum ground-level ozone levels calculated and observed for the Winnipeg downtown monitoring site.

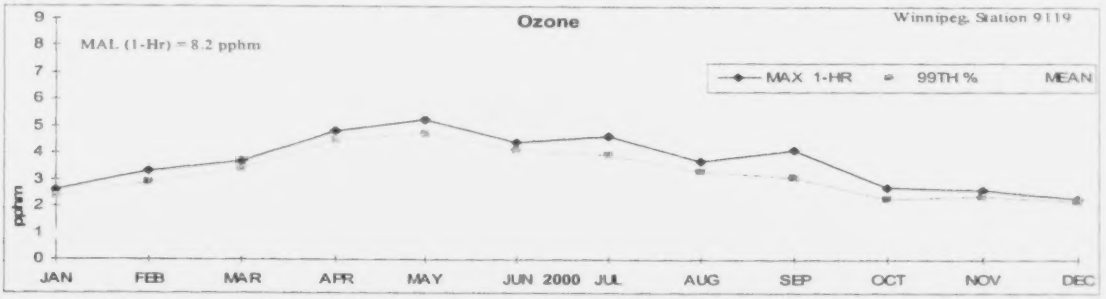

Figure 14 Monthly mean and 1-Hr maximum ground-level ozone levels calculated and observed for the Winnipeg downtown monitoring site for 2000.

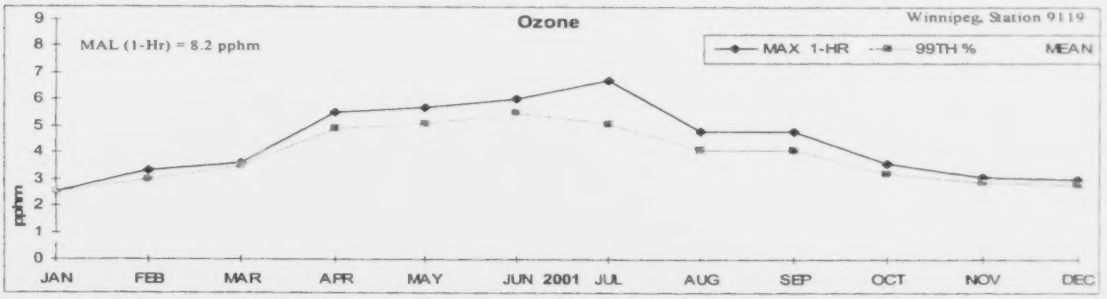

Figure 15 Monthly mean and 1-Hr maximum ground-level ozone levels calculated and observed for the Winnipeg downtown monitoring site for 2001.

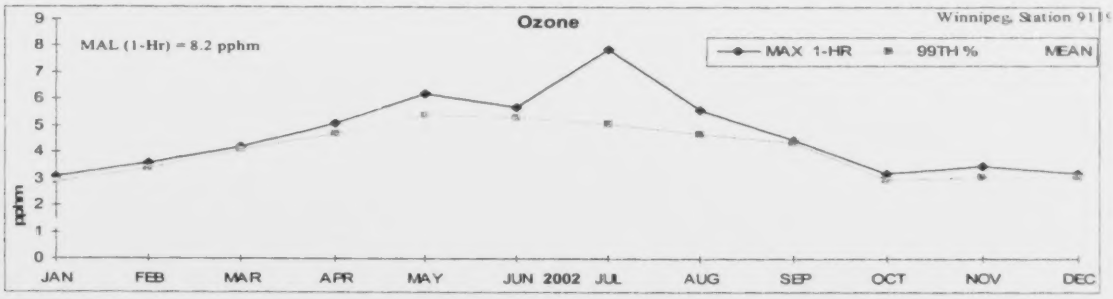

Figure 16 Monthly mean and 1-Hr maximum ground-level ozone levels calculated and observed for the Winnipeg downtown monitoring site for 2002.

Nitrogen Dioxide

NO_2 levels in downtown Winnipeg continued to be well below the Manitoba Air Quality Objectives, as in previous years. Average monthly values, for 2000, 2001 and 2002 respectively, are shown in Figures 18 to 20 and were slightly higher than at the residential location. Yearly trends are shown in Figure 17.

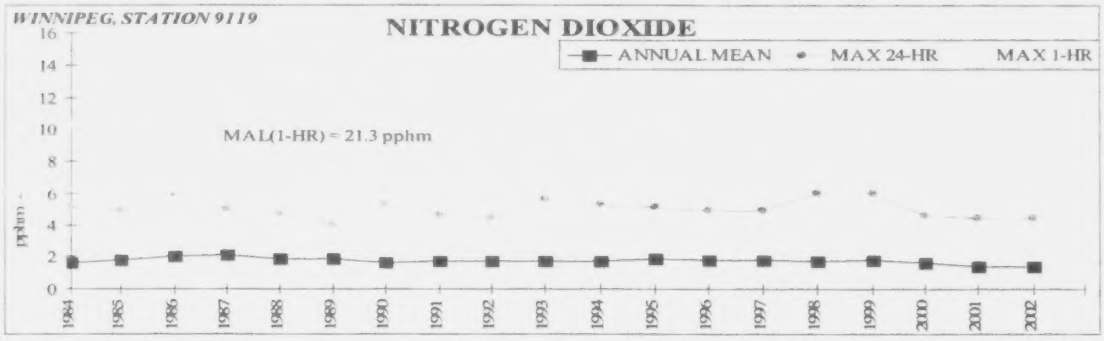

Figure 17 Annual mean, 24-Hr and 1-Hr maximum nitrogen dioxide levels calculated and observed for the Winnipeg downtown monitoring site.

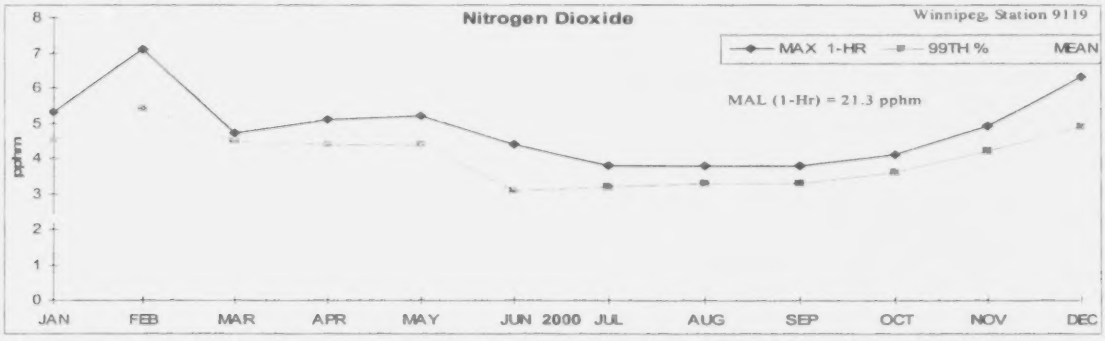

Figure 18 Monthly mean and 1-Hr maximum nitrogen dioxide levels calculated and observed for the Winnipeg downtown monitoring site for 2000.

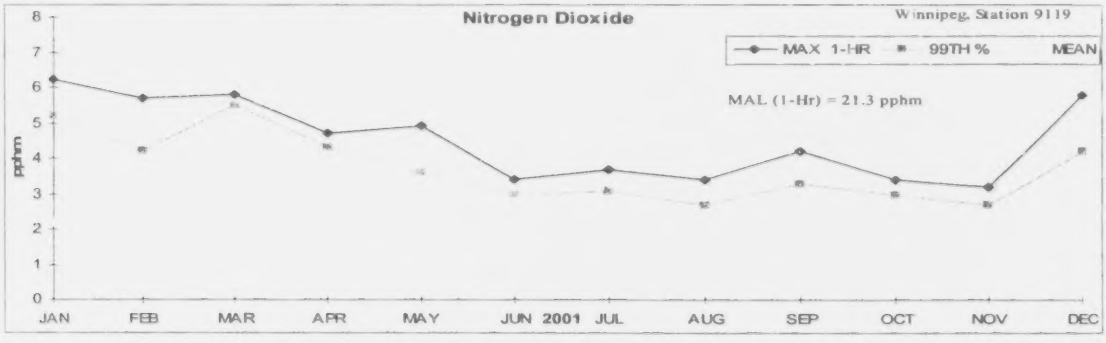

Figure 19 Monthly mean and 1-Hr maximum nitrogen dioxide levels calculated and observed for the Winnipeg downtown monitoring site for 2001.

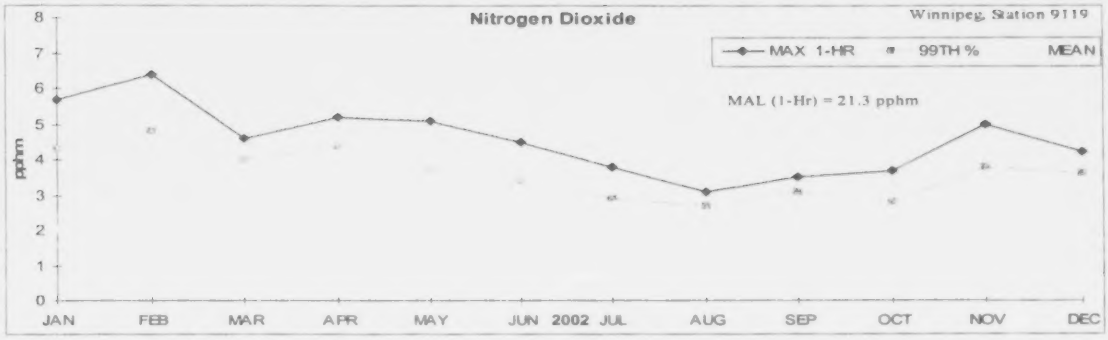

Figure 20 Monthly mean and 1-Hr maximum nitrogen dioxide levels calculated and observed for the Winnipeg downtown monitoring site for 2002.

Nitric Oxide and Nitrogen Oxides

NO and NO_x annual data statistics are summarized in Tables 3, 5 and 7. Manitoba has no Air Quality Objectives or Guidelines for either NO or NO_x.

Total Suspended Particulate (TSP)

TSP samples, collected four days out of every six day rotation, at the downtown monitoring station numbered 225 (61.6% of the year) for 2000, 220 (60.3%) for 2001 and 224 (61.4%) for 2002.

The annual geometric mean for TSP in downtown Winnipeg was higher than at the Winnipeg residential and Brandon sites. Yearly trends are shown in Figure 21 and monthly values are shown in Figures 22, 23 and 24 for 2000, 2001 and 2002, respectively. The 24-hour MAL of 120 $\mu g/m^3$ was exceeded by nine samples in 2000, three samples in 2001 and eleven samples in 2002 (Figure 25). The maximum 24-hour values and the number of samples above the 24-hour MAL have decreased from 1991. Elevated TSP levels observed are primarily from wind-entrained landscape dust and vehicle-raised dust on city streets. In 2002, both the daily maximum and the annual mean rose over the previous two years dues to a high dust event in early March, which can be attributed to dusty city streets and a high dust event in early May.

Figure 21 Annual mean and 24-Hr maximum TSP levels calculated and observed for the Winnipeg downtown monitoring site for the period 1978 through 2002.

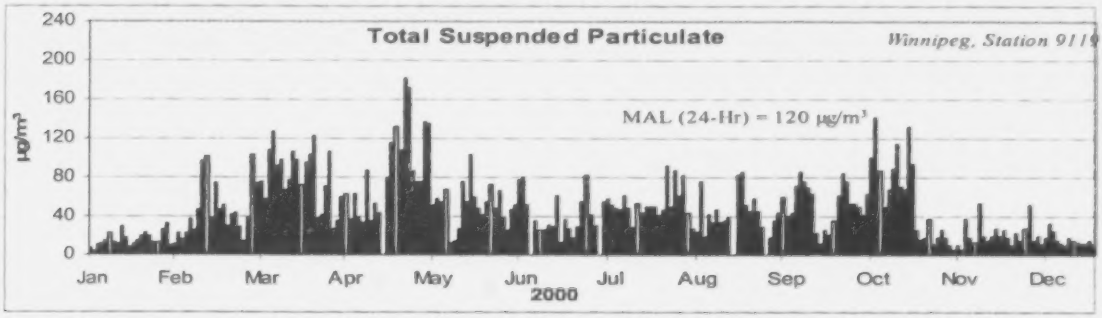

Figure 22 Volume-weighted 24-Hr TSP levels calculated and observed for the Winnipeg downtown monitoring site for 2000.

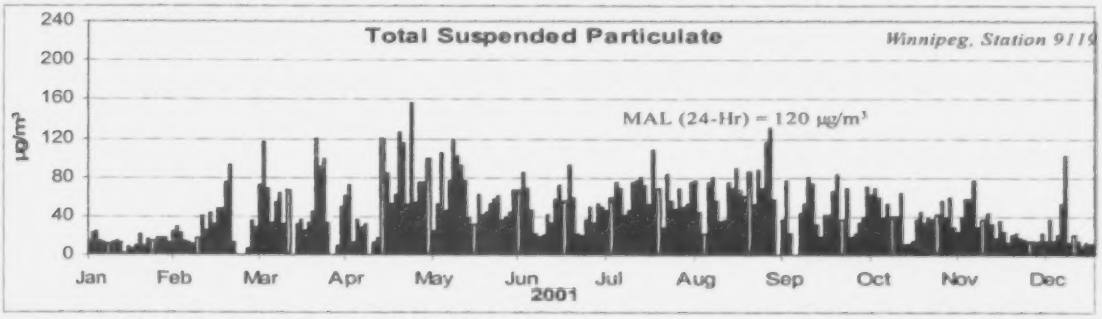

Figure 23 Volume-weighted 24-Hr TSP levels calculated and observed for the Winnipeg downtown monitoring site for 2001.

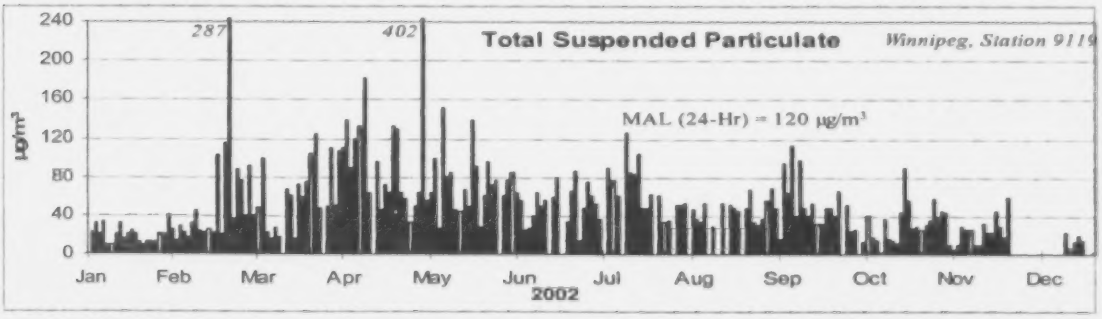

Figure 24 Volume-weighted 24-Hr TSP levels calculated and observed for the Winnipeg downtown monitoring site for 2002.

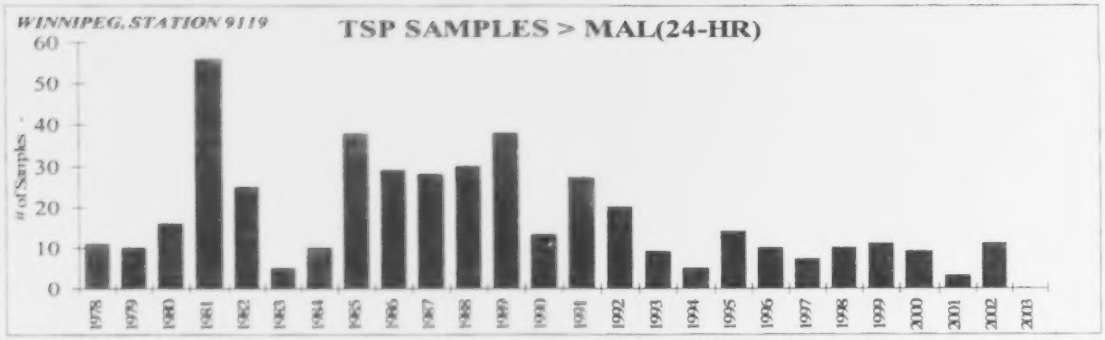

Figure 25 Number of exceedences of the 24-hour MAL (120 µg/m^3) observed for the Winnipeg downtown monitoring site for the period 1978 through 2002 on an annual basis.

Inhalable Particulates (PM_{10} and $PM_{2.5}$)

PM_{10} levels were monitored at the downtown station using both a dichotomous sampler (sampling once every six days) and a real-time TEOM sampler. The monthly dichotomous values are shown in Figures 26, 27 and 28 for 2000, 2001 and 2002, respectively. The relative proportion of fine to coarse inhalable particulate is shown graphically and the annual mean fine/coarse ratio was 0.31 in 2000, 0.33 in 2001 and 0.36 in 2002. The daily average PM_{10} level as determined by continuous (24/7) measurement (TEOM unit) are shown in figures 29a, 30a and 31a for 2000, 2001 and 2002, respectively. Hourly averages are shown in figures figures 29b, 30b and 31b for 2000, 2001 and 2002, respectively. Yearly statistical results from both the dichotomous (once every sixth day sampling) and real-time (continuous) samplers are shown in Tables 4a, 6a and 8a for 2000, 2001 and 2002, respectively. Objectives or Guidelines for this parameter have not been established.

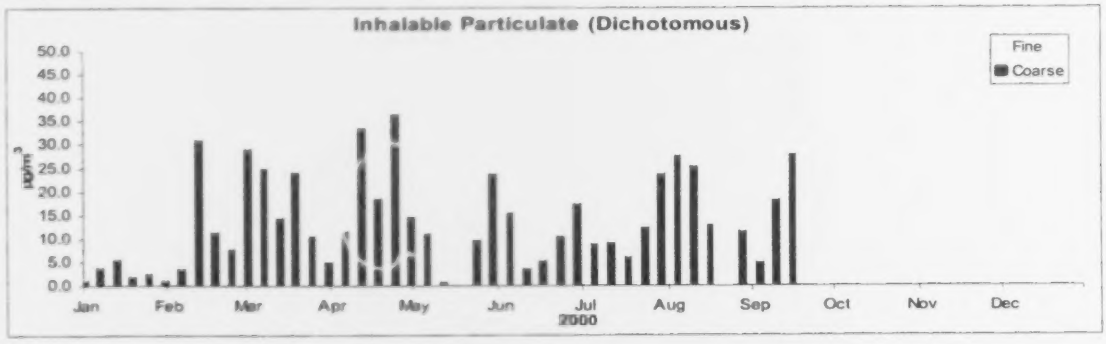

Figure 26 Inhalable particulate levels (fine [< 2.5 µm in diameter] plus coarse [2.5 µm to 10 µm in diameter]) by sample date (per 24-Hr sample) for 2000

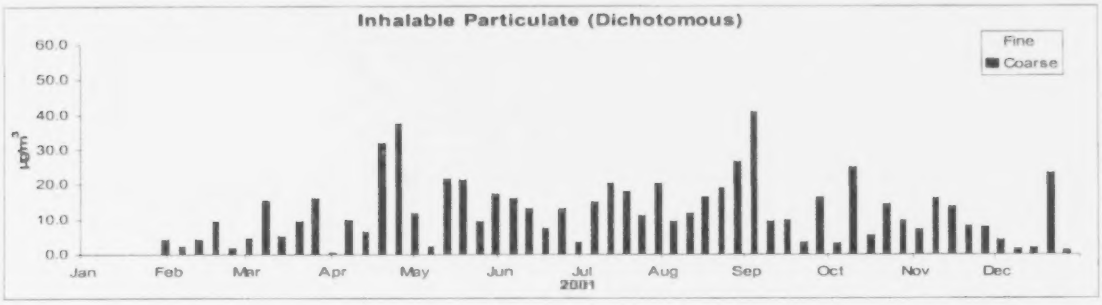

Figure 27 Inhalable particulate levels (fine [< 2.5 µm in diameter] plus coarse [2.5 µm to 10 µm in diameter]) by sample date (per 24-Hr sample) for 2001.

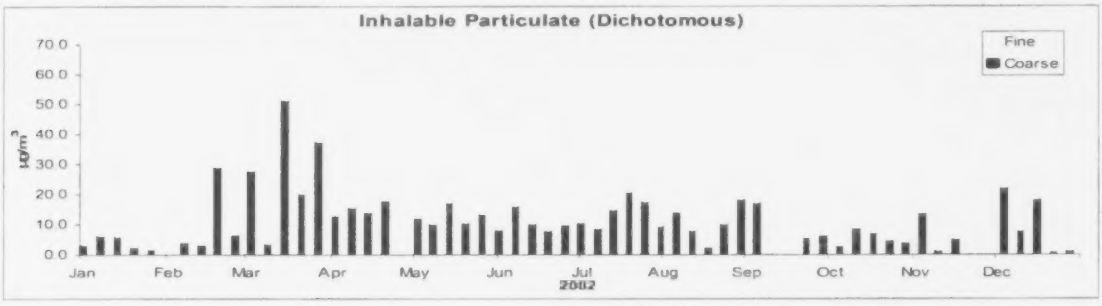

Figure 28 Inhalable particulate levels (fine [< 2.5 µm in diameter] plus coarse [2.5 µm to 10 µm in diameter]) by sample date (per 24-Hr sample) for 2002.

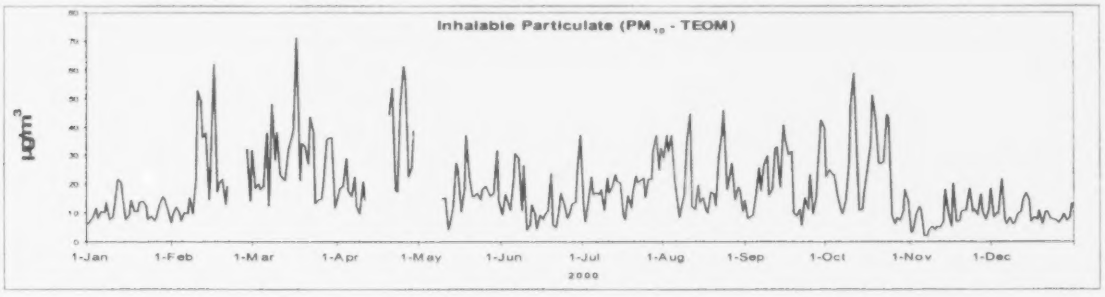

Figure 29a Inhalable particulate levels - PM_{10}: daily averages for 2000.

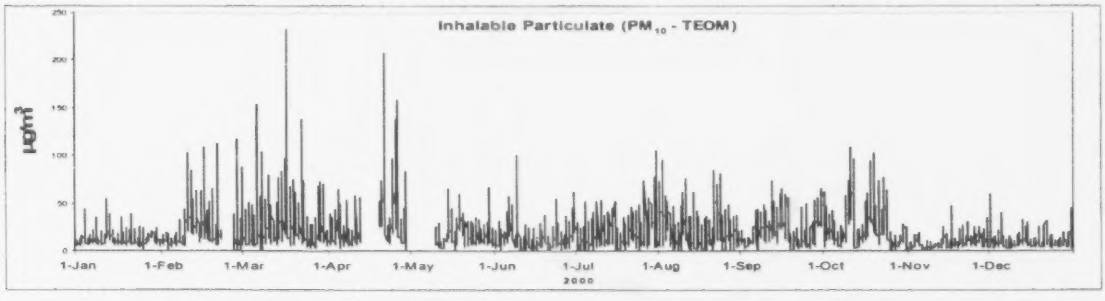

Figure 29b Inhalable particulate levels - PM_{10}: hourly averages for 2000.

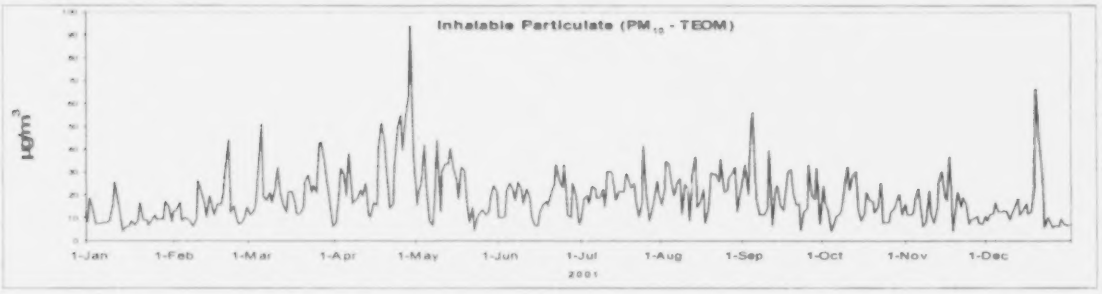

Figure 30a Inhalable particulate levels - PM_{10}: daily averages for 2001.

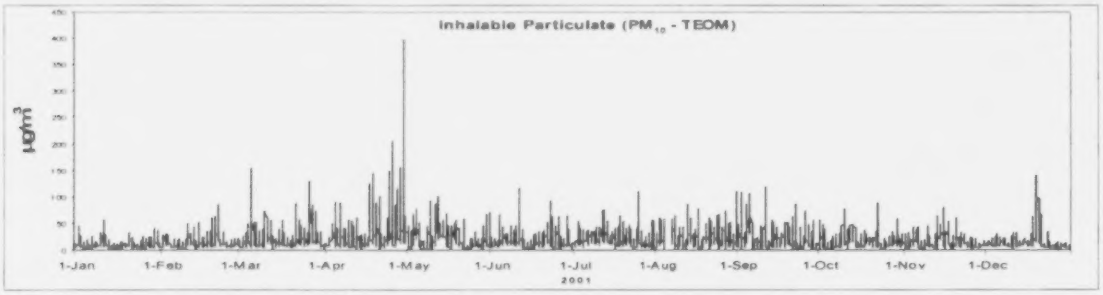

Figure 30b Inhalable particulate levels - PM_{10}: hourly averages for 2001.

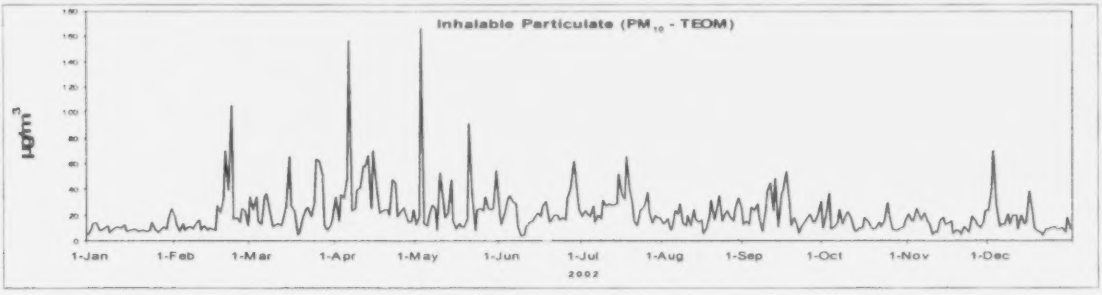

Figure 31a Inhalable particulate levels - PM_{10}: daily averages for 2002.

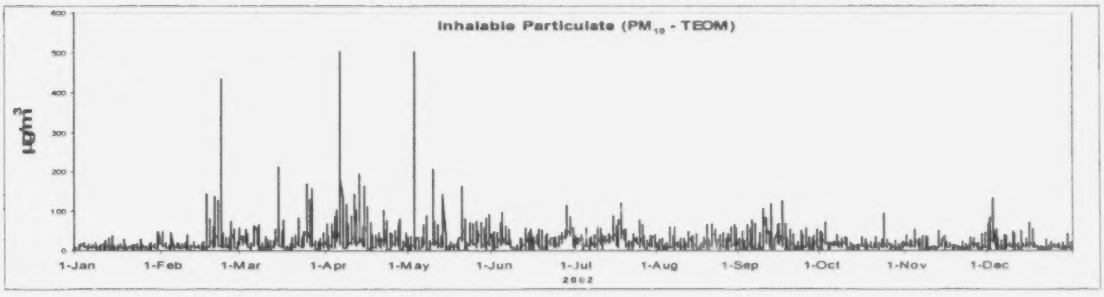

Figure 31b Inhalable particulate levels - PM_{10}: houly averages for 2002.

The real-time TEOM sampler for $PM_{2.5}$ came on-line late in 2000. Data from this sampler are presented in Tables 3b, 5b and 7b for 2000, 2001 and 2002 respectively. The fine to coarse ratio (using $PM_{2.5}/[PM_{10} - PM_{2.5}]$) is 0.41 for 2001 and 0.41 for 2002. Both of these values are slightly higher than the ratio determined from the dichotomous sampler. The daily average $PM_{2.5}$ level as determined by the TEOM unit are shown in figures 32a and 33a for 2001 and 2002, respectively. Figures 32b and 33b display the hourly averages as determined by the TEOM unit.

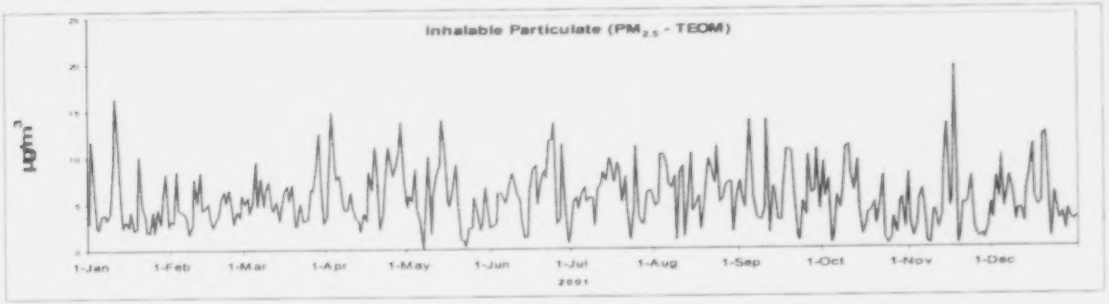

Figure 32a Inhalable particulate levels - $PM_{2.5}$: daily averages for 2001.

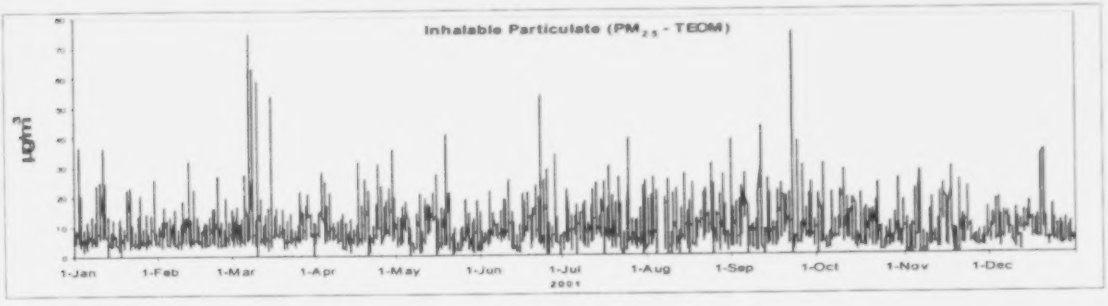

Figure 32b Inhalable particulate levels - $PM_{2.5}$: hourly averages for 2001.

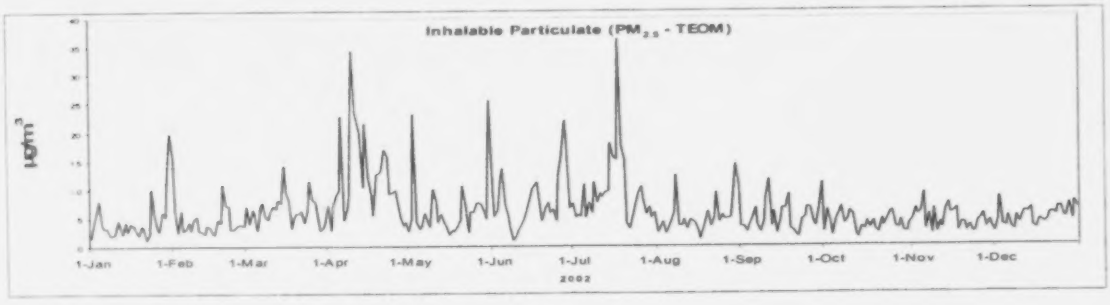

Figure 33a Inhalable particulate levels - $PM_{2.5}$: daily averages for 2002.

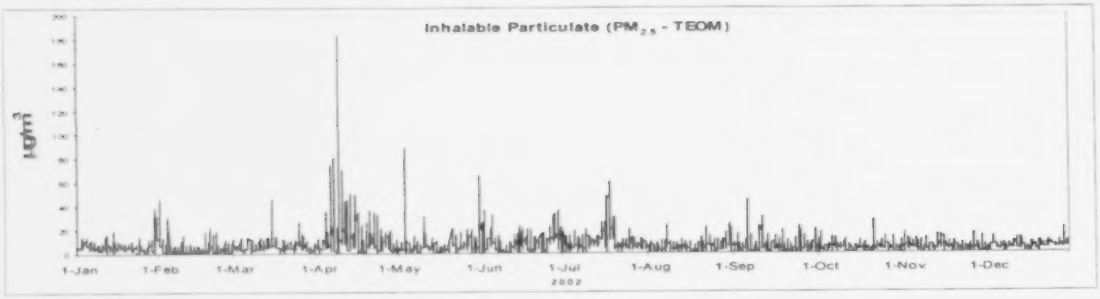

Figure 33b Inhalable particulate levels - $PM_{2.5}$ hourly averages for 2002.

Volatile Organic Compounds (VOCs)

VOC annual statistics for 150 compounds are shown in Tables 8, 9 and 10 for 2000, 2001 and 2002, respectively. Manitoba does not have Objectives or Guidelines for VOCs but Ontario has promulgated standards for some, none of which were exceeded at this station. Benzene, a carcinogen, had a mean level of 1.05, 1.08 and 1.03 ug/m^3 in 2000, 2001 and 2002, respectively. All three values were lower than the value for 1999, which to this point had been the lowest average observed for the 1990's.

Polycyclic-aromatic Hydrocarbons (PAHs)

PAH monitoring (Table 11) found that of the 30 compounds screened for, 27 were detected in all of the 30 samples collected between 1 January 2000 and 24 August 2002. One compound was present in 19 of the 30 samples, and 2 compounds were not present in any samples. Of the 30 compounds listed, only one, Benzo(a)pyrene, has a Guideline limit (Ontario) of 1.1 ng/m^3 for a 24-hr period and 0.3 ng/m^3 for an annual mean. The maximum observed level of 0.47 ng/m^3 for a 24-hr period and 0.077 ng/m^3 for the annual mean for benzo(a)pyrene are both well below the Ontario Guideline limit. Manitoba does not have Guidelines or Objectives for any of the other 29 compounds in Table 11.

Polychlorinated Dibenzo-p-dioxins and Dibenzo-p-furans (PCDDs & PCDFs)

Table 12 lists the summary results of the 28 samples collected from January 1, 2000 to August 24, 2002.

Ontario has a 24-hour criteria of 5 pgTEQ/m^3 for chlorinated dibenzo-p-dioxins. A TEQ is a PCDD isomer's toxicity equivalence to 2,3,7,8-TCDD.

The 2000-2002 mean, for the total PCDD/PCDF concentration was 0.30 pg/m^3 and for TEQ was 0.02 TEQ pg/m^3. Generally, for the sampling period the sample day TEQs were on average 1/100th the Ontario criteria.

Aldehydes and Ketones (Carbonyls)

In 1997, on March 11 the NAPS Program began sampling for carbonyl compounds (13 aldehydes and 4 ketones) in ambient air. Table 13 lists the compounds sampled for, along with the three year average value (2000-2002) and the maximum value observed in a 24-hour sample. Of these sixteen compounds Ontario has ambient criteria for 6 of these compounds, five of which are 24-hour criteria and the sixth is a 1-hour criteria. Quebec has annual average air quality criteria for the following six compounds: formaldehyde (0.08 µg/m^3), acetaldehyde (0.5 µg/m^3), acrolein (0.2 µg/m^3), acetone (180 µg/m^3), MEK (820 µg/m^3), and benzaldehyde (200 µg/m^3). In Winnipeg, the concentrations determined for the compounds were all well below the criteria.

Residential

The description of Winnipeg residential air quality is based on sampling conducted at station #9118 (299 Scotia Street), a NAPS Class 1 site. The parameters measured at this site were: CO, NO_2, NO, NO_x, O_3, $PM_{2.5}$, and TSP.

Carbon Monoxide

The annual mean level of CO has not varied much over the last twenty years. Yearly trends are shown in Figure 34 and monthly values in Figures 35, 36 and 37. The average levels were lower than at the Winnipeg downtown station and there were no excursions above the Provincial Criteria in 2000, 2001 and 2002.

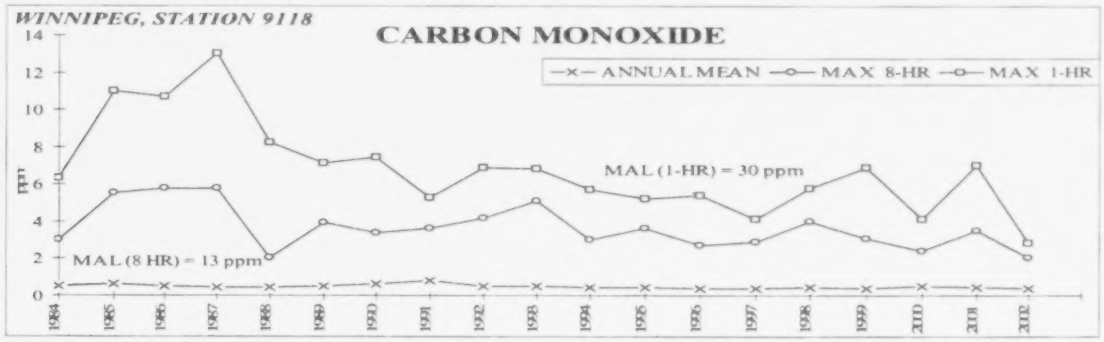

Figure 34 Annual mean, 8-Hr and 1-Hr maximum carbon monoxide levels calculated and observed for the Winnipeg residential monitoring site 1984 - 2002.

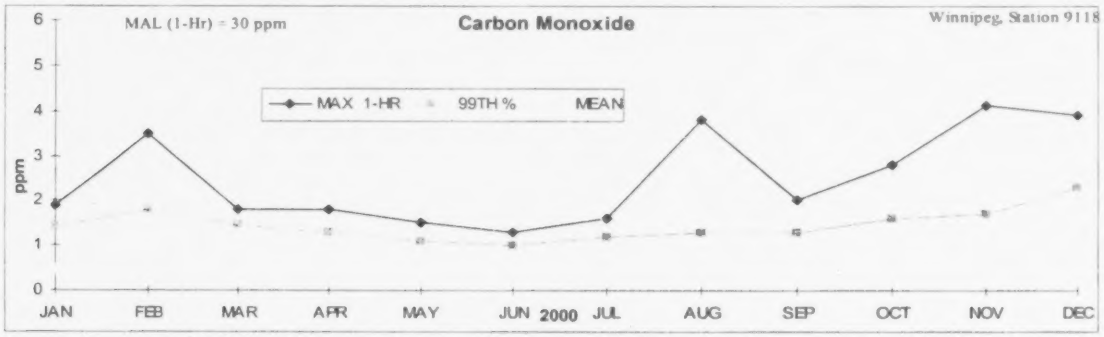

Figure 35 Monthly mean, 8-Hr and 1-Hr maximum carbon monoxide levels calculated and observed for the Winnipeg residential monitoring site for 2000.

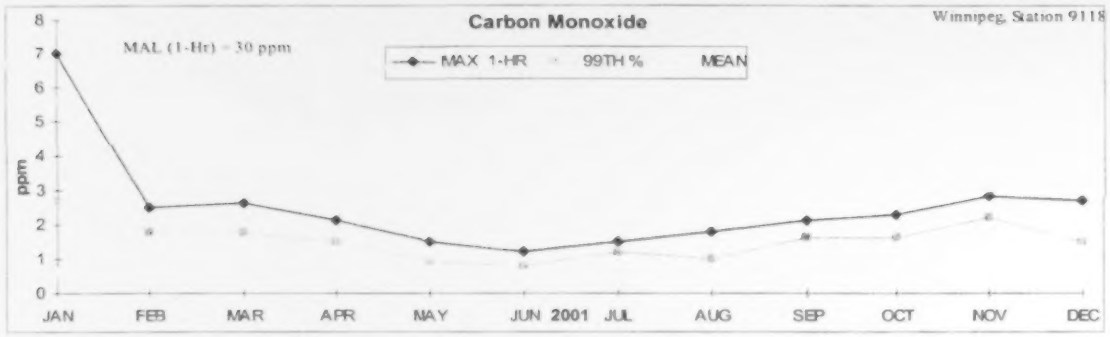

Figure 36 Monthly mean, 8-Hr and 1-Hr maximum carbon monoxide levels calculated and observed for the Winnipeg residential monitoring site for 2001.

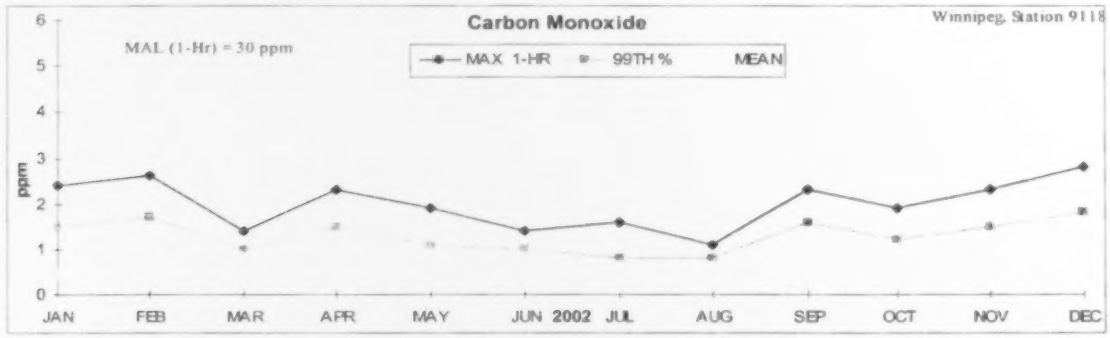

Figure 37 Monthly mean, 8-Hr and 1-Hr maximum carbon monoxide levels calculated and observed for the Winnipeg residential monitoring site for 2002.

Ozone

Ground level O_3 at the residential station had the second lowest annual means, for 2000, 2001 and 2002 of the three stations that monitored ozone in Manitoba. Annual trends are shown in Figure 38. Monthly levels are shown in Figures 39, 40 and 41. The 1-hour MAL of 8.2 pphm has not been exceeded since 1989.

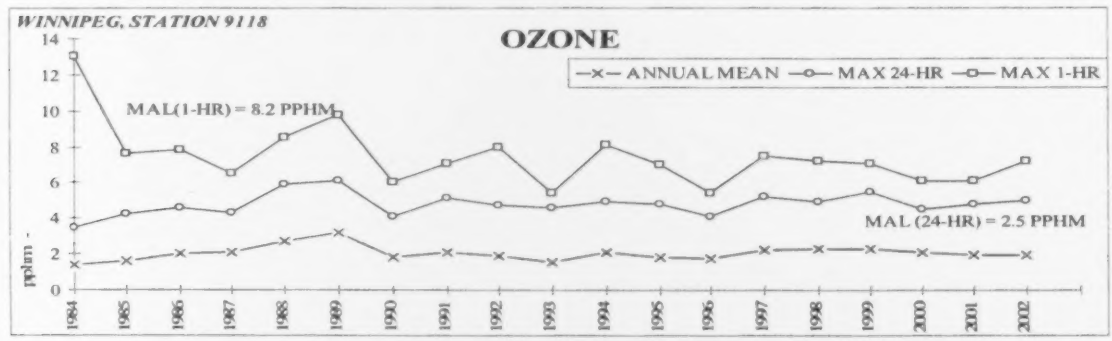

Figure 38 Annual mean, 24-Hr and 1-Hr maximum ground-level ozone levels calculated and observed for the Winnipeg residential monitoring site.

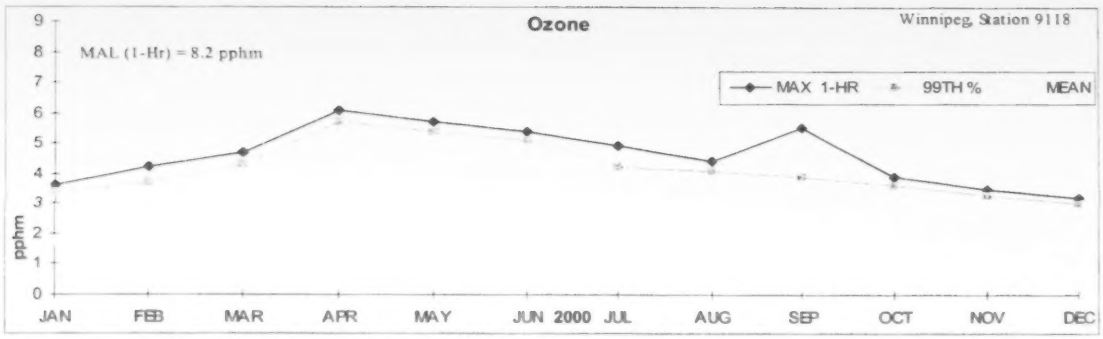

Figure 39 Monthly mean and 1-Hr maximum ground-level ozone levels calculated and observed for the Winnipeg residential monitoring site for 2000.

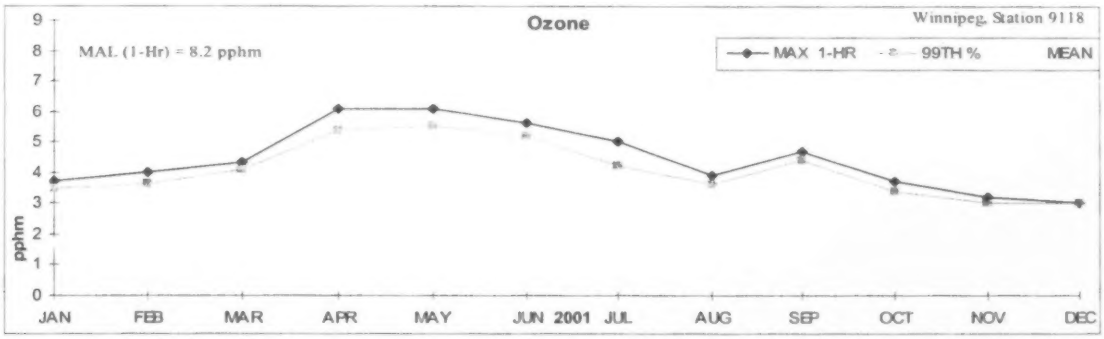

Figure 40 Monthly mean and 1-Hr maximum ground-level ozone levels calculated and observed for the Winnipeg residential monitoring site for 2001.

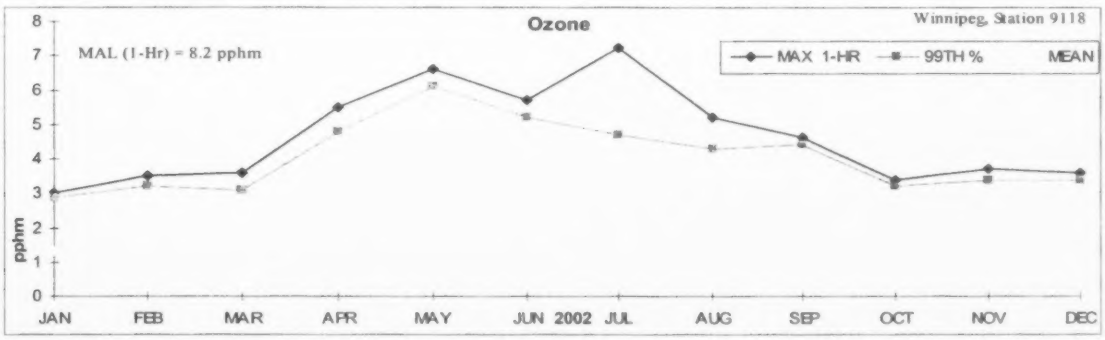

Figure 41 Monthly mean and 1-Hr maximum ground-level ozone levels calculated and observed for the Winnipeg residential monitoring site for 2002.

Nitrogen Dioxide

NO_2 levels were generally lower than those measured downtown. Yearly trends are shown in Figure 42 and monthly values are depicted in Figures 43 to 45. Annual mean levels were similar to those found in previous years. All recorded levels were below the Ambient Air Quality Criteria.

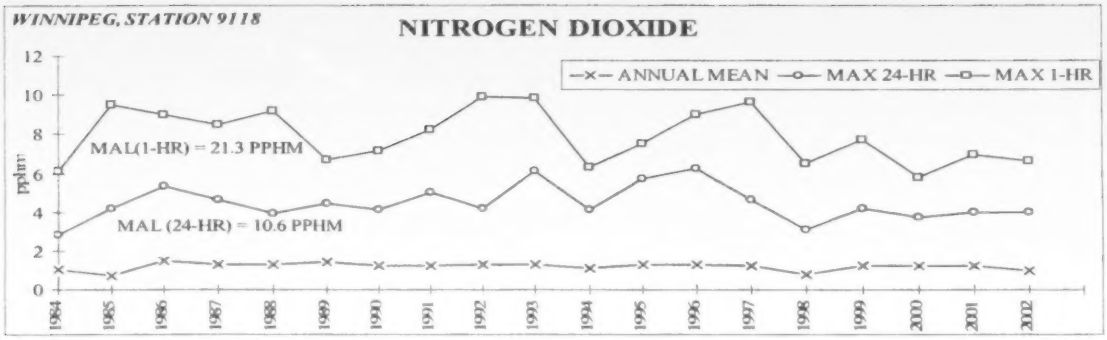

Figure 42 Annual mean, 24-Hr and 1-Hr maximum nitrogen dioxide levels calculated and observed for the Winnipeg residential monitoring site.

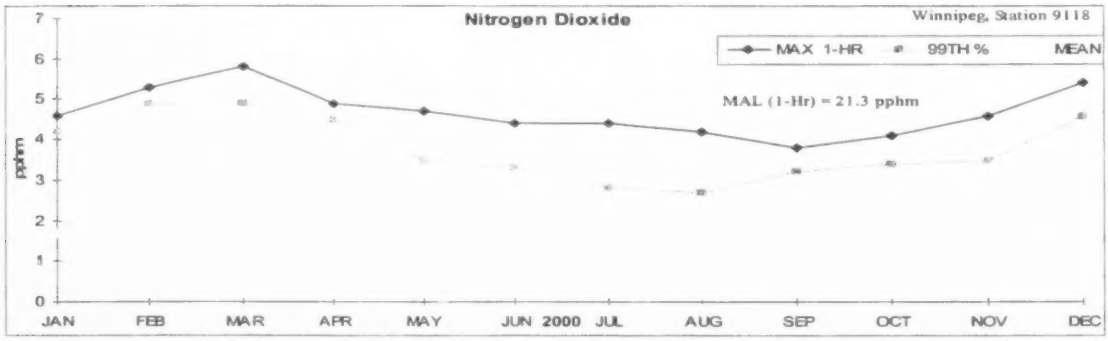

Figure 43 Monthly mean and 1-Hr maximum nitrogen dioxide levels calculated and observed for the Winnipeg residential monitoring site for 2000.

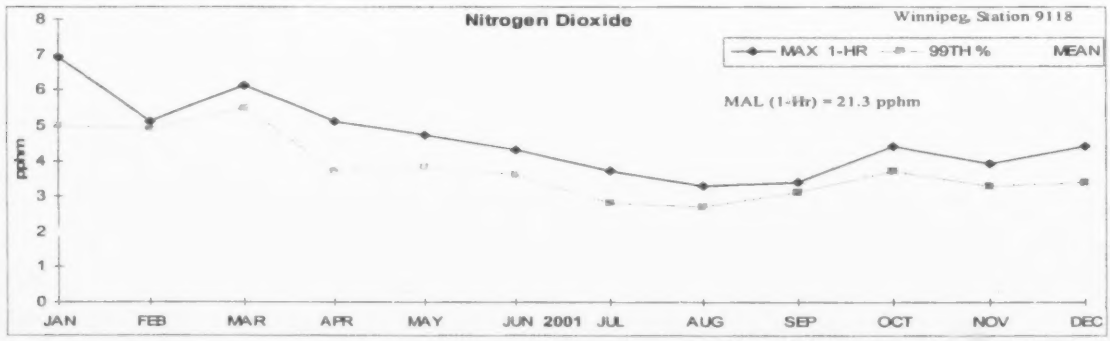

Figure 44 Monthly mean and 1-Hr maximum nitrogen dioxide levels calculated and observed for the Winnipeg residential monitoring site for 2001.

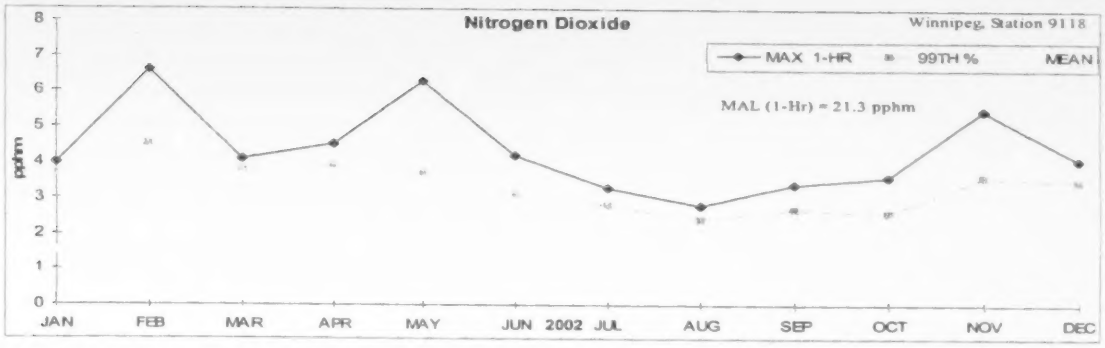

Figure 45 Monthly mean and 1-Hr maximum nitrogen dioxide levels calculated and observed for the Winnipeg residential monitoring site for 2002.

Nitric Oxide and Nitrogen Oxides

NO and NO_x yearly statistical results are shown in Tables 3, 5 and 7. Ambient Air Quality Criteria for NO or NO_x have not been established.

Total Suspended Particulate (TSP)

TSP samples, which were collected every sixth day at the residential monitoring station, number 58 out of a possible 61 samples for 2000. For 2001, 60 out of a possible 61 samples are reported on and for 2002, 55 out of a possible 61 samples are reported on. Yearly trends are shown in Figure 46 and monthly values are shown in Figures 47, 48 and 49 for 2000, 2001 and 2002, respectively. Most values were generally lower than at the other sites monitored by the Department. There were no exceedences of the 24-hour MAL being observed in 2000, 2001 or 2002 (Figure 50).

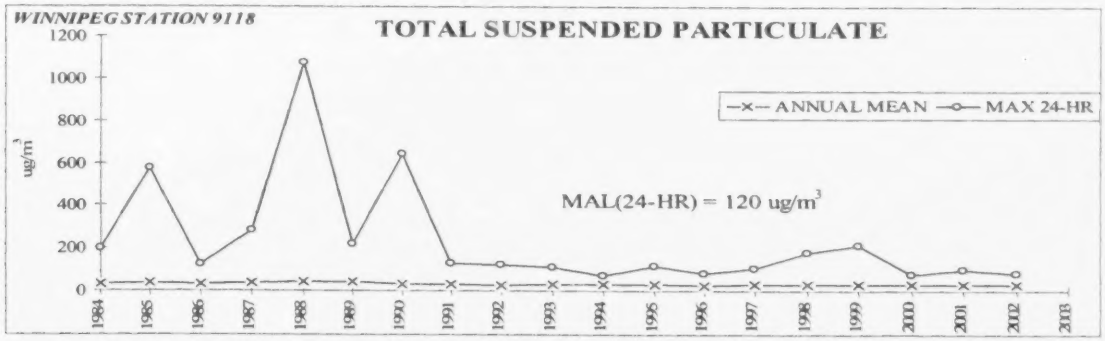

Figure 46 Annual and 24-Hr maximum TSP levels calculated and observed for the Winnipeg residential monitoring site for the period 1984 through 2002.

Figure 47 Volume-weighted 24-Hr TSP levels calculated and observed for the Winnipeg residential monitoring site for 2000.

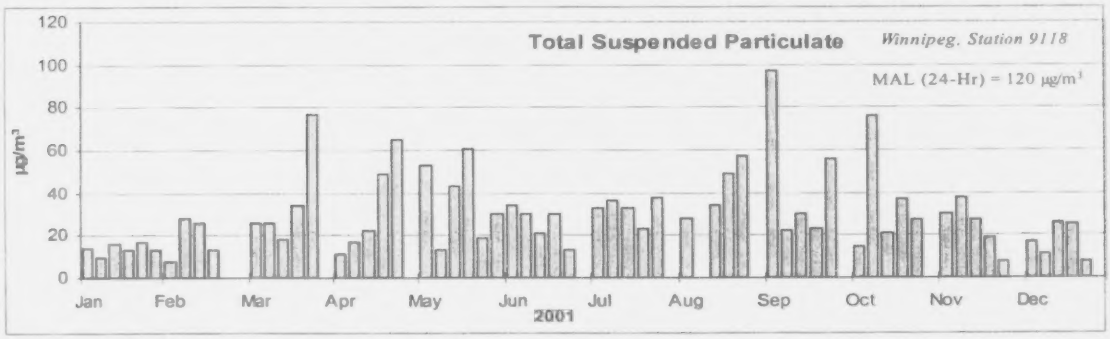

Figure 48 Volume-weighted 24-Hr TSP levels calculated and observed for the Winnipeg residential monitoring site for 2001.

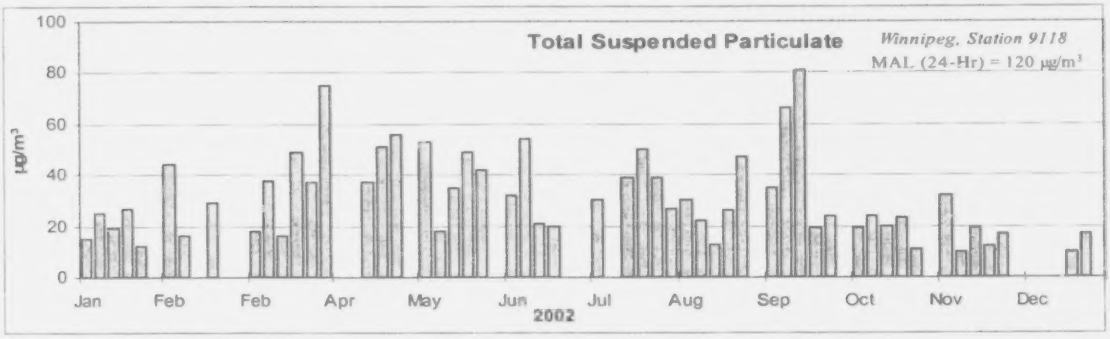

Figure 492 Volume-weighted 24-Hr TSP levels calculated and observed for the Winnipeg residential monitoring site for 2002.

Figure 50 Number of exceedences of the 24-hour MAL (120 µg/m^3) observed for the Winnipeg residential monitoring site for the period 1984 through 2002 on an annual basis.

Inhalable Particulates ($PM_{2.5}$)

The hourly and daily average $PM_{2.5}$ level as determined by continuous (24/7) measurement (TEOM unit) are shown in Figures 51a and b, 52a and b and 53a and b for 2000, 2001 and 2002, respectively. Yearly statistical results are shown in Tables 4b, 6b and 8b for $PM_{2.5}$ data for 2000, 2001 and 2002, respectively. Objectives or guidelines for these parameters have not been established.

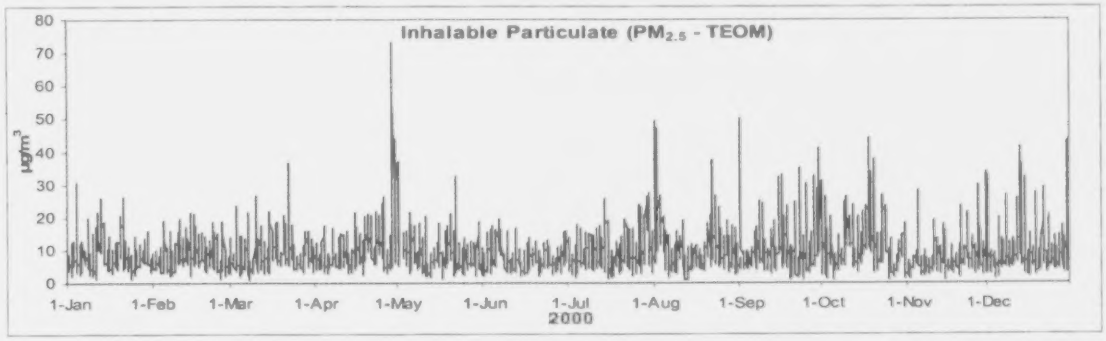

Figure 51a Inhalable particulate ($PM_{2.5}$) levels - Hourly averages for 2000.

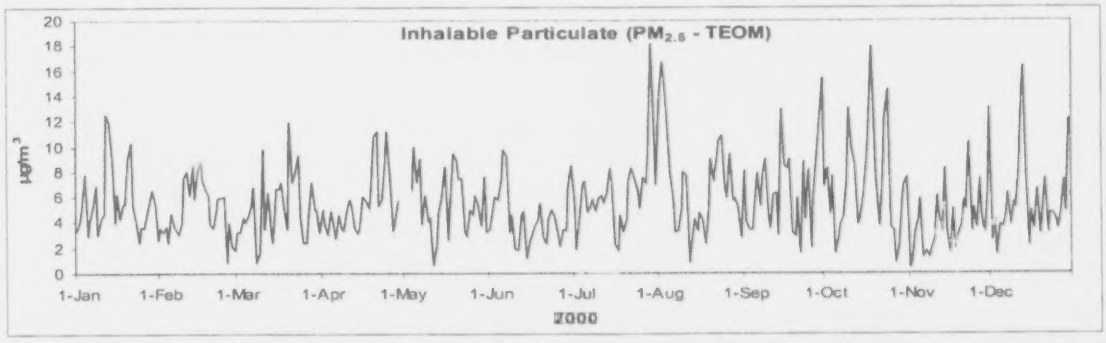

Figure 51b Inhalable particulate ($PM_{2.5}$) levels - Daily averages for 2000.

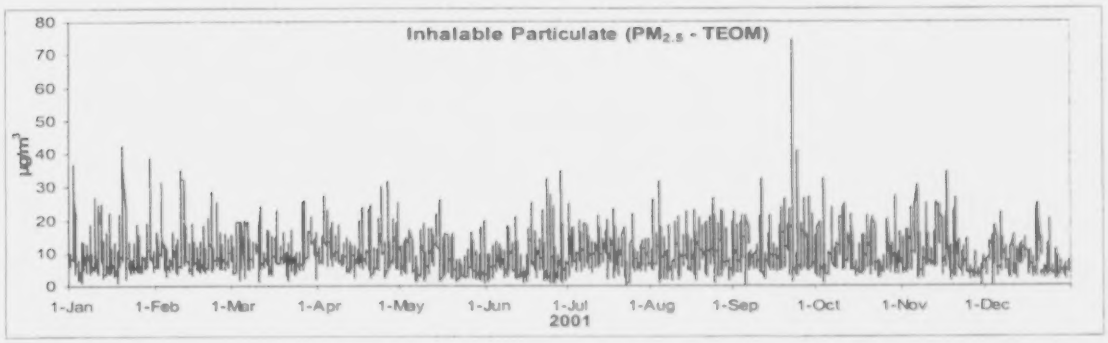

Figure 52a Inhalable particulate ($PM_{2.5}$) levels - Hourly averages for 2001.

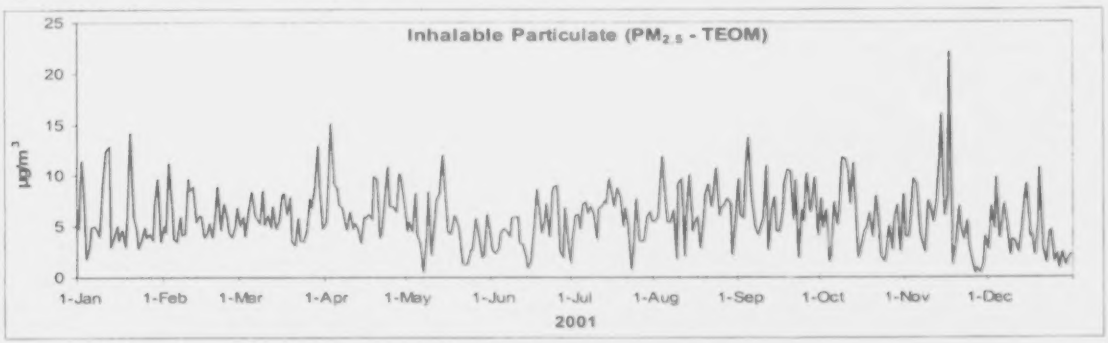

Figure 52b Inhalable particulate ($PM_{2.5}$) levels - Daily averages for 2001.

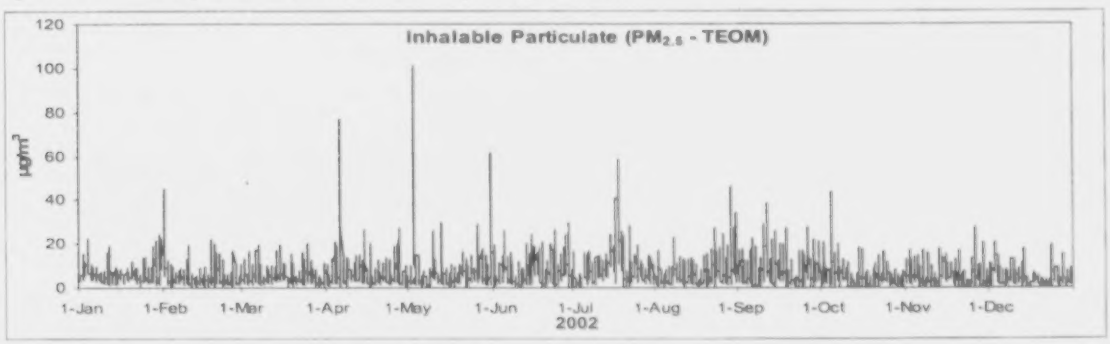

Figure 53a Inhalable particulate ($PM_{2.5}$) levels - Hourly averages for 2002.

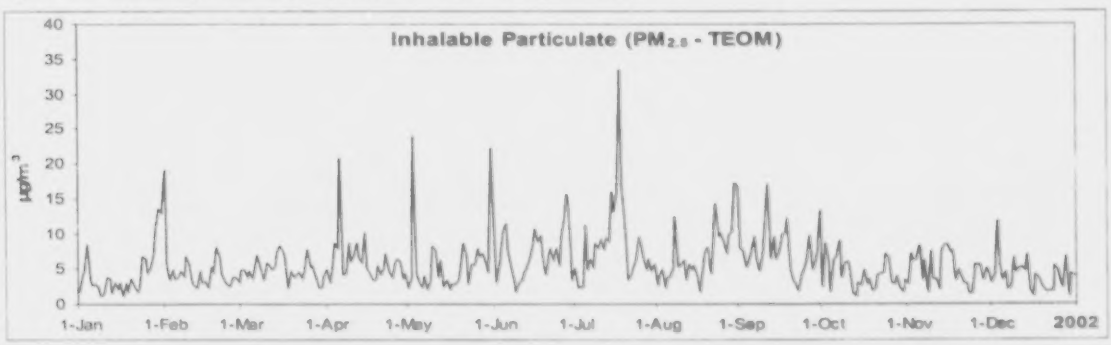

Figure 53b Inhalable particulate ($PM_{2.5}$) levels - Daily averages for 2002.

B. BRANDON AIR QUALITY

Industrial

Air quality in the eastern industrial area of Brandon was monitored at station #5131 on the grounds of Assiniboine Community College. This station monitored NO_x, NO_2, NO, O_3, PM_{10} and NH_3. In June of 2001, a R&P TEOM $PM_{2.5}$ analyzer was added to the suite of instruments at the monitoring location.

Air Quality Index

Although not disseminated, an AQI is generated for the Brandon Industrial site using the following pollutants: 24-Hr PM_{10}, 24-Hr $PM_{2.5}$, NH_3, NO_2 and O_3. The Air Quality Index (Figures 54, 55 and 56, Table 15) was in the Good range for 90% of the time in 2000, 2001 and 2002 (discounting N/A times). In 2000, the number of Fair hours was 580, in 2001 there were 658 Fair hours, while in 2002 the number of fair hours climbed to 821. In all three years, the major influencing factor was ground-level ozone followed by 24-hr PM_{10} and then 24-hr $PM_{2.5}$. In 2000, there were 36 hours where the Air Quality was Poor, while in 2001 and 2002 there were 62 and 28 hours, respectively. As well there were 35 and 24 hours of Very Poor air quality at this location in 2001 and 2002, respectively. Looking at the summaries for 2001 and 2002 the majority of Fair/Poor/Very Poor air quality events, due to high dust levels, ocurred during the 2nd quarter of the year. In 2000, all of the Poor Air Quality occurred in the 4th quarter.

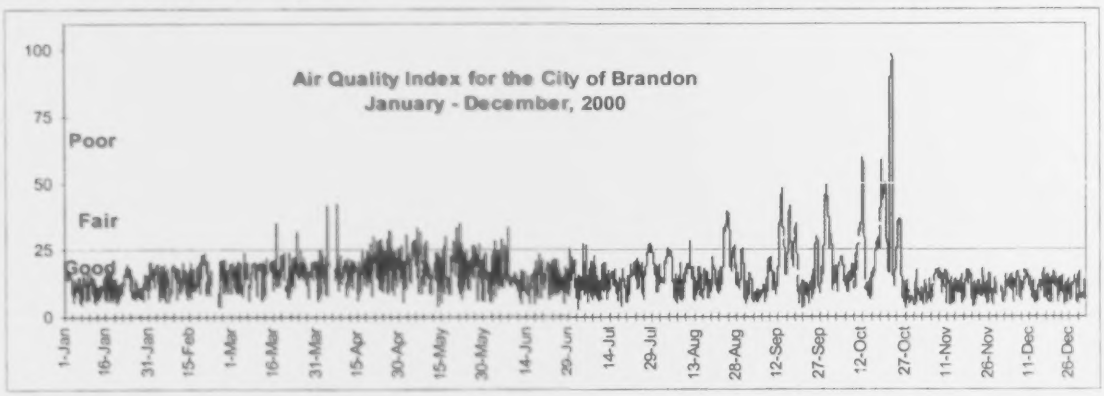

Figure 54. The Air Quality Index for Brandon (Industrial Site) for 2000.

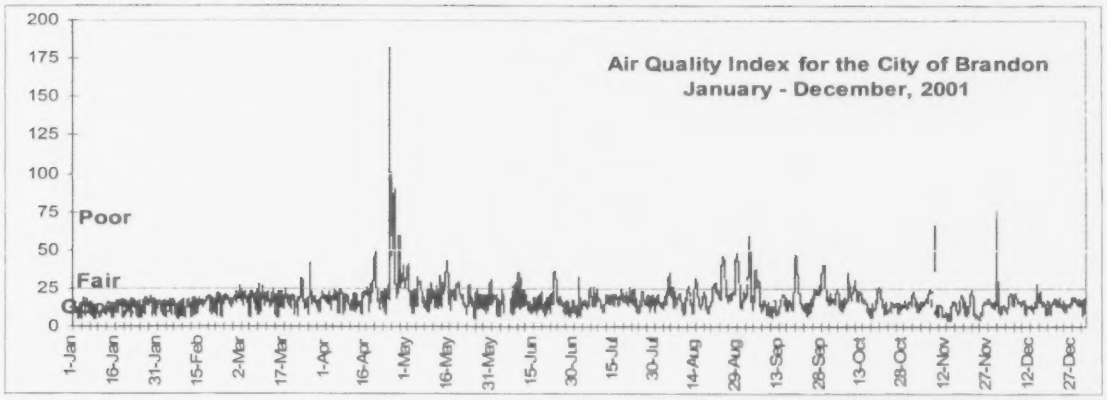

Figure 55. The Air Quality Index for Brandon (Industrial Site) for 2001.

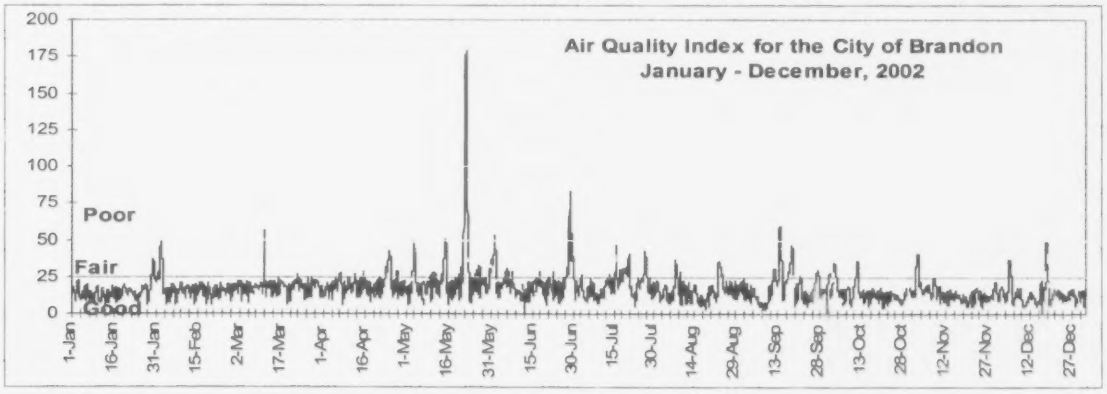

Figure 56. The Air Quality Index for Brandon (Industrial Site) for 2002.

Table 15: Summary of AQI for Brandon (Industrial) by Category and determining Pollutant for 2000, 2001 and 2002 (by quarters).

	Number of Hours					
2000	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total	%
Good	2009	1867	1860	1859	7595	92.5%
Fair	7	147	248	178	580	7.1%
Poor	0	0	0	36	36	0.4%
V.Poor	0	0	0	0	0	0%
N/A	168	170	100	135	573	--
Total	2184	2184	2208	2208	8784	100%
NH_3	5	4	0	1	10	0.1%
24 PM_{10}	246	272	1144	644	2306	28.1%
NO_2	93	3	0	66	162	2.0%
O_3	1672	1735	694	1362	5733	69.8%
N/A	168	170	100	135	573	--
Total	2184	2184	2208	2208	8784	100%

Table 15: Summary of AQI for Brandon (Industrial) by Category and determining Pollutant for 2000, 2001 and 2002 (by quarters).

	Number of Hours					
2001	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total	%
Good	2033	1639	1804	2060	7536	90.9%
Fair	28	310	290	30	658	7.9%
Poor	0	47	8	7	62	0.8%
V.Poor	0	35	0	0	35	0.4%
N/A	99	153	106	111	469	--
Total	2160	2184	2208	2208	8760	100%
NH_3	5	0	2	3	10	0.1%
24 PM_{10}	218	654	600	416	1888	22.8%
24 $PM_{2.5}$	0	83	900	865	1848	22.3%
NO_2	117	1	0	0	118	1.4%
O_3	1721	1293	600	813	4427	53.4%
N/A	99	153	106	111	469	--
Total	2160	2184	2208	2208	8760	100%

2002	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total	%
Good	1999	1691	1782	1959	7431	89.5%
Fair	57	331	316	117	821	9.9%
Poor	1	20	7	0	28	0.3%
V.Poor	0	24	0	0	24	0.3%
N/A	103	118	103	132	456	--
Total	2160	2184	2208	2208	8760	100%
NH3	3	2	4	8	17	0.2%
24 PM_{10}	44	466	1016	510	2036	24.5%
24 $PM_{2.5}$	225	232	192	333	982	11.8%
NO_2	28	3	0	15	46	0.6%
O_3	1757	1363	893	1210	5223	62.9%
N/A	103	118	103	132	456	--
Total	2160	2184	2207	2208	8759	100%

N/A The AQI would not be available 4% of the time or 1 in every 24 hours due to the internal calibrations that occur each day at 3 a.m. CST. Additional N/A times would occur during routine instrument maintenance and repair.

Ozone

Ground level O_3 monthly levels at Brandon site #5131 are shown in Figures 57, 58 and 59. The annual means were higher than the Winnipeg stations and a decrease in levels was observed in 2000 to 2002 as

compared to 1995/6. There have been no excursions above the 1-hour MAL (8.2 pphm) since 1986. Yearly trends are shown in Figure 60.

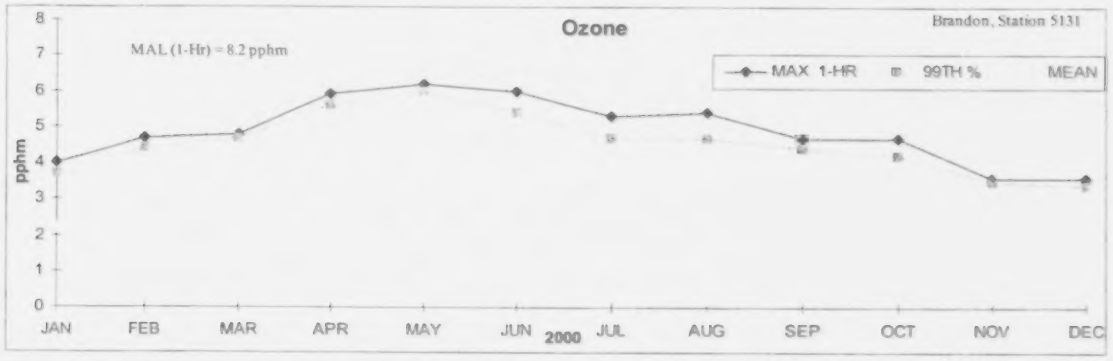

Figure 57. Monthly mean and 1-Hr maximum ground-level ozone levels calculated and observed for the Brandon industrial monitoring site for 2000.

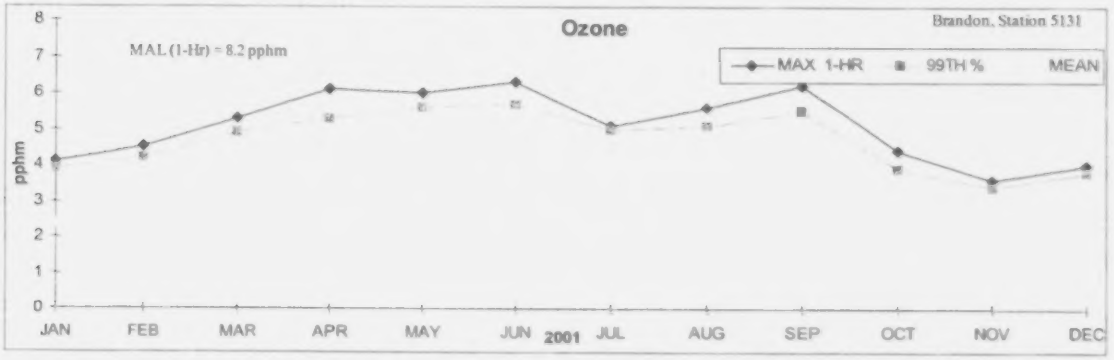

Figure 58. Monthly mean and 1-Hr maximum ground-level ozone levels calculated and observed for the Brandon industrial monitoring site for 2001.

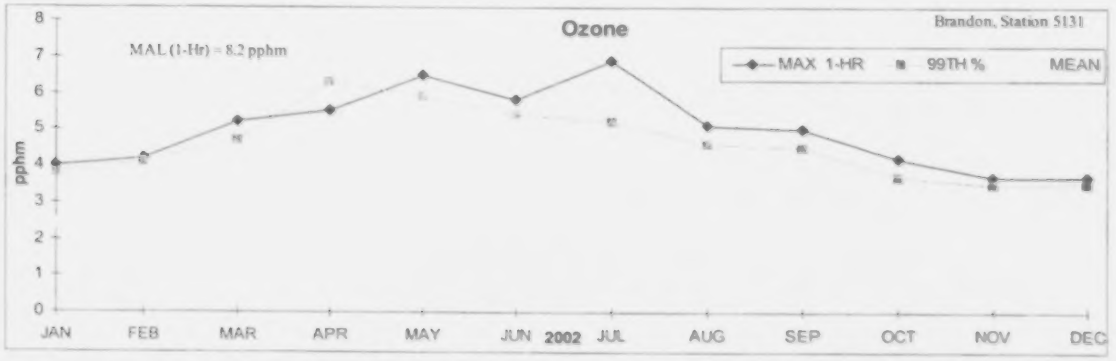

Figure 59. Monthly mean and 1-Hr maximum ground-level ozone levels calculated and observed for the Brandon industrial monitoring site for 2002.

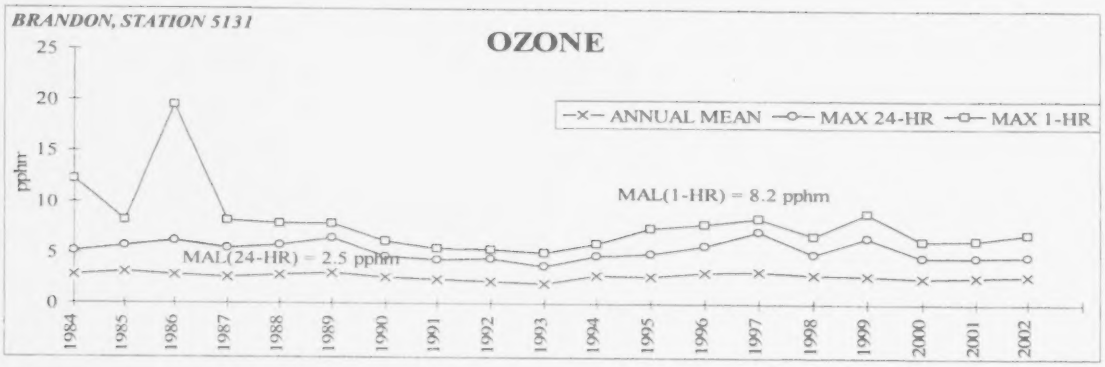

Figure 60. Annual mean, 24-Hr and 1-Hr maximum ground-level ozone levels calculated and observed for the Brandon industrial monitoring site.

Ammonia (NH_3)

NH_3 monitoring at station #5131 is source-specific for air emissions from a fertilizer manufacturer. The monthly levels are shown in Figures 64, 65 and 66, and the yearly trends are shown in Figures 67 and 68. The Manitoba Conservation licenced regulatory limit issued to the fertilizer company of 3.0 ppm (1-hour average) was exceeded once in 2000 and twice in 2002. There were no exceedences of the Licence limit in 2001. The MAL Guideline of 2.0 ppm for any one hour period was exceeded on 1 occasion in 2000, on 5 occasions in 2001 and on 2 occasions in 2002.

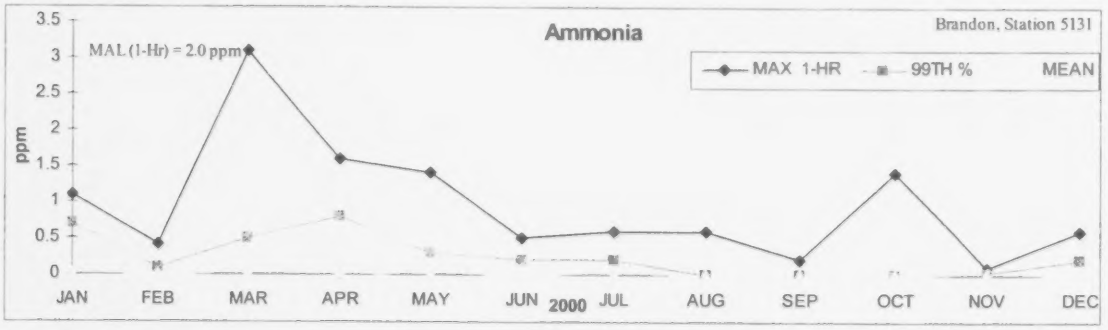

Figure 61. Monthly mean and 1-Hr maximum ammonia levels calculated and observed for the Brandon industrial monitoring site for 2000.

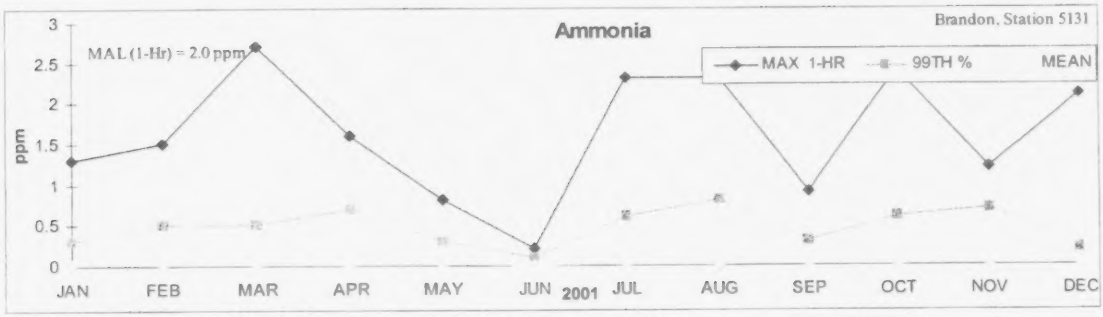

Figure 62. Monthly mean and 1-Hr maximum ammonia levels calculated and observed for the Brandon industrial monitoring site for 2001.

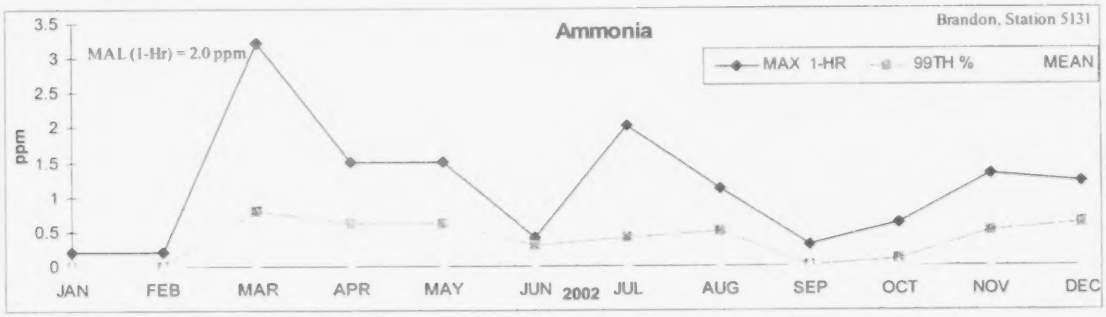

Figure 63. Monthly mean and 1-Hr maximum ammonia levels calculated and observed for the Brandon industrial monitoring site for 2002.

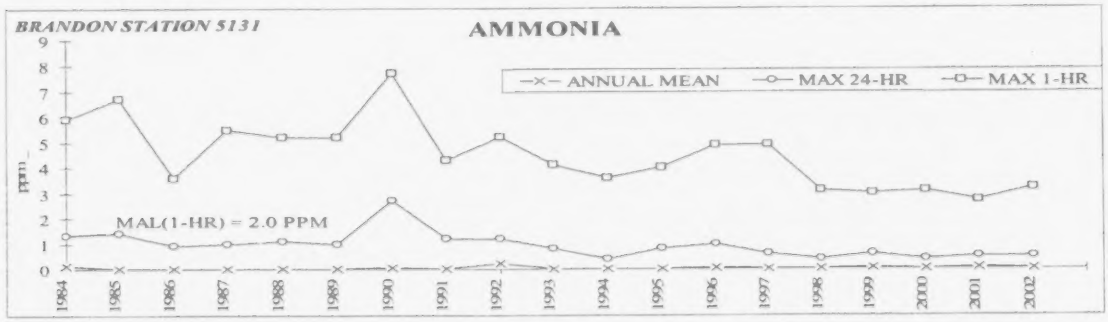

Figure 64. Annual mean, 24-Hr and 1-Hr maximum ammonia levels calculated and observed for the Brandon industrial monitoring site.

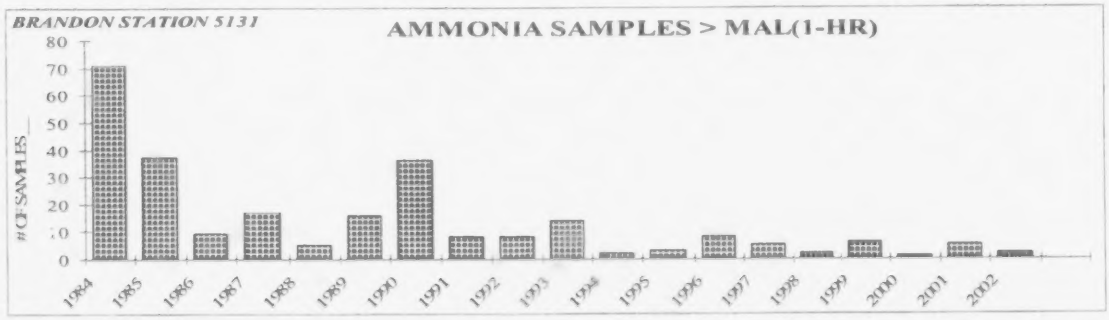

Figure 65. Number of exceedences of the 1-hour MAL (2.0 ppm) observed for the Brandon industrial monitoring site for the period 1984 through 2002 on an annual basis.

C. FLIN FLON AIR QUALITY

Air Quality Index

Since 1997, an AQI has been generated for the downtown Flin Flon site using the following pollutants: 24-Hr PM_{10}, 1- Hr SO_2 and 24-Hr SO_2. *[Cautionary Note - Since a full range of monitoring is not undertaken at this site (i.e., O_3 not monitored) , there is a potential to underestimate the air quality index.]* In 2002, a $PM_{2.5}$ analyzer was added to the suite of instruments and 24-hr $PM_{2.5}$ was added to the AQI determination. The Air Quality Index (Figures 66, 67 and 68, Table 16) was in the Good range for over 80% of the time in 2000, 2001 and 2002 (discounting N/A times). During this time period, air quality was Fair 10-13% of the time (discounting N/A times) and in the Poor range for 3-5% of the time.

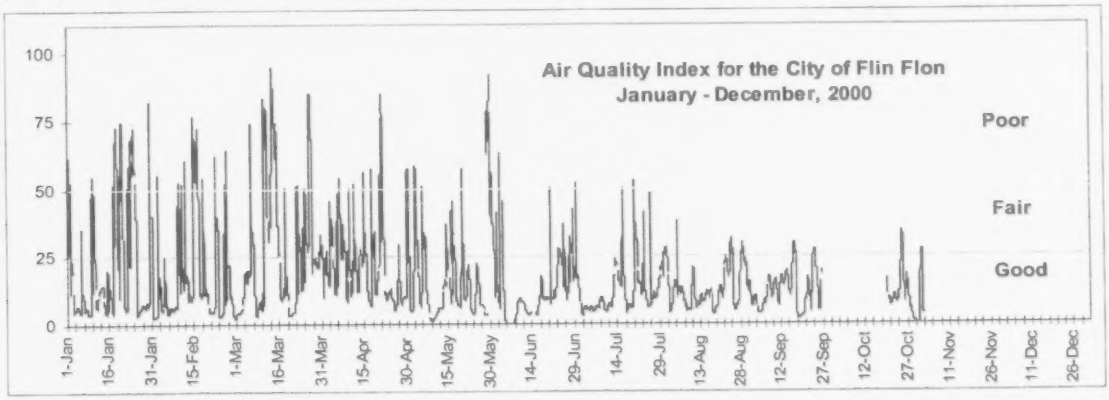

Figure 66. The Air Quality Index for Flin Flon (Downtown Site) for 2000.

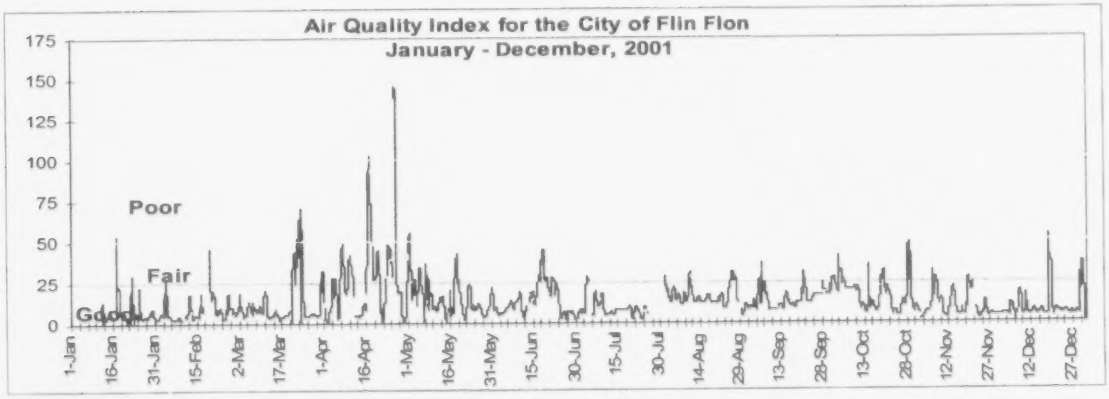

Figure 67. The Air Quality Index for Flin Flon (Downtown Site) for 2001.

In 2002, the number of Very Poor hours were halved from 2001 dropping to 10 from 21. In all three years the major influencing factor was PM_{10} (averaged over 24 hours) followed by 24-hour SO_2 and then 1-hour SO_2 (a distant third). In 2002, with the addition of another parameter, 24-hr-$PM_{2.5}$ was in third place just behind 24-hr SO_2. Basing a comparison on the last three quarters of the year, 2002 it can be stated that 24-hr $PM_{2.5}$ was the second most significant contributing factor after 24-hr PM_{10}.

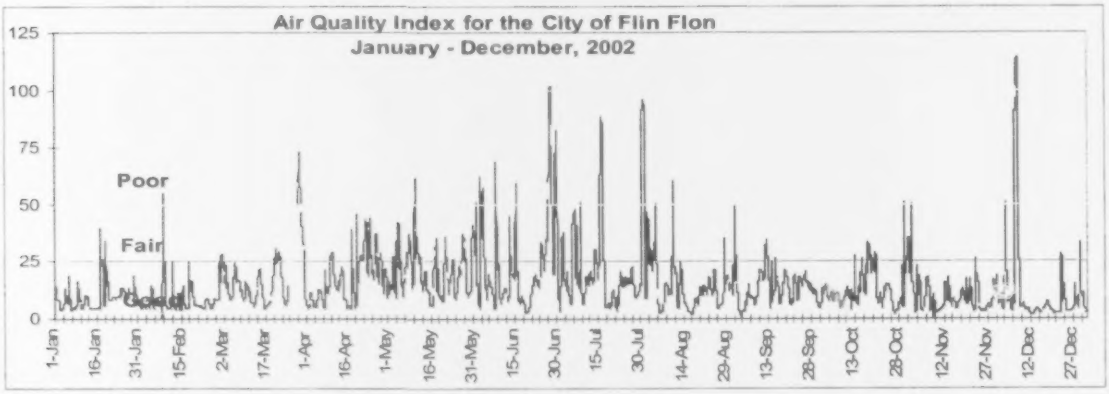

Figure 68. The Air Quality Index for Flin Flon (Downtown Site) for 2002.

Table 16: Summary of AQI for Flin Flon (Downtown) by Category and determining Pollutant for 2000, 2001 and 2002 (by quarters).

	Number of Hours					
2000	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total	%
Good	1505	1634	1879	259	5277	81.8%
Fair	321	354	130	39	844	13.1%
Poor	258	69	2	0	329	5.1%
V.Poor	0	0	0	0	0	0%
N/A	100	127	197	1910	2334	--
Total	2184	2184	2208	2208	8784	100%
SO_2	102	138	21	41	302	4.7%
24 SO_2	639	295	51	4	989	15.3%
24 PM_{10}	1343	1624	1939	253	5159	80.0%
N/A	100	127	197	1910	2334	--
Total	2184	2184	2208	2208	8784	100%

Table 16: Summary of AQI for Flin Flon (Downtown) by Category and determining Pollutant for 2000, 2001 and 2002 (by quarters).

	Number of Hours					
2001	1st Qtr	2 nd Qtr	3 rd Qtr	4 th Qtr	Total	%
Good	1632	1538	1841	1915	6926	89.3%
Fair	74	424	81	157	736	9.5%
Poor	29	38	0	2	69	0.9%
V.Poor	0	21	0	0	21	0.3%
N/A	425	163	286	134	1008	--
Total	2160	2184	2208	2208	8760	100%
SO_2	70	26	14	44	154	2.0%
24 SO_2	307	44	881	740	1972	25.4%
24 PM_{10}	1358	1951	1027	1290	5626	72.6%
N/A	425	163	286	134	1008	--
Total	2160	2184	2208	2208	8760	100%

2002	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total	%
Good	1846	1512	1839	1992	7189	87.1%
Fair	96	488	209	94	887	10.8%
Poor	27	73	46	17	163	2.0%
V.Poor	0	2	0	8	10	0.1%
N/A	191	109	114	97	511	--
Total	2160	2184	2208	2208	8760	100%
SO_2	44	51	45	68	208	2.5%
24 SO_2	1007	149	91	166	1413	17.1%
24 PM_{10}	918	1387	1427	1517	5249	63.6%
24 $PM_{2.5}$		488	531	360	1379	16.7%
N/A	191	109	114	97	511	--
Total	2160	2184	2208	2208	8760	100%

N/A The AQI would not be available 4% of the time or 1 in every 24 hours due to the internal calibrations that occur each day at 3 a.m. CST. Additional N/A times would occur during routine instrument maintenance and repair.

Sulphur Dioxide (SO_2)

SO_2 is monitored in Flin Flon by the Province at 143 Main Street, located in downtown Flin Flon. The primary source of SO_2 is a major zinc-copper smelter located near the downtown area, straddling the Manitoba-Saskatchewan border. This company maintained four monitoring sites of its own.

Reported SO_2 emissions for 2000, 2001 and 2002 from this complex were 138, 185, and 178 kilotonnes per year, respectively. At the downtown site there were 105 excursions above the 1-hour MAL of 0.34 ppm in 2000, 64 in 2001 and 80 exceedences in 2002. Monthly and yearly data are shown in Figures 69 to 74 and Tables 2, 4 and 6. Yearly trends are shown in Figures 75 and 76. For comparison purposes, monthly data for the four company-operated monitoring sites are included (Figures 77 to 100).

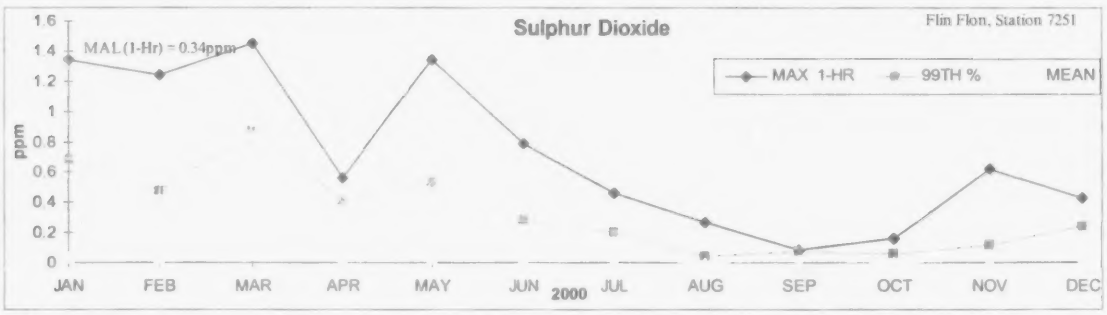

Figure 69. Monthly mean and 1-Hr maximum sulphur dioxide levels calculated and observed for the Flin Flon Provincial monitoring site for 2000.

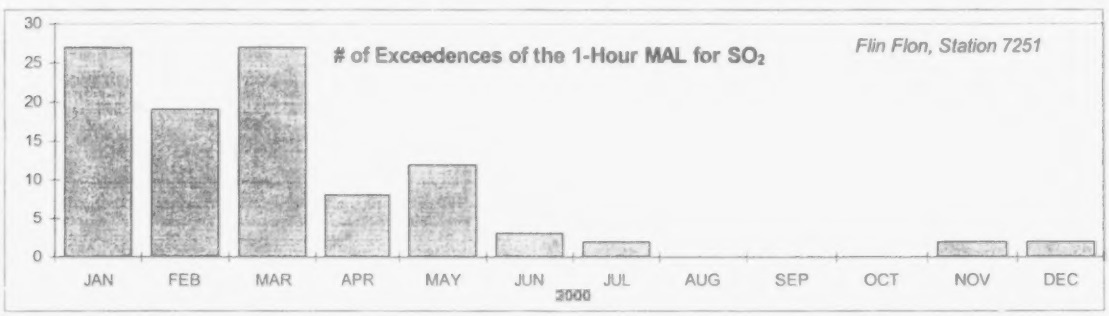

Figure 70. Number of exceedences of the 1-hour MAL for SO_2 for 2000 recorded at the Provincial monitoring site.

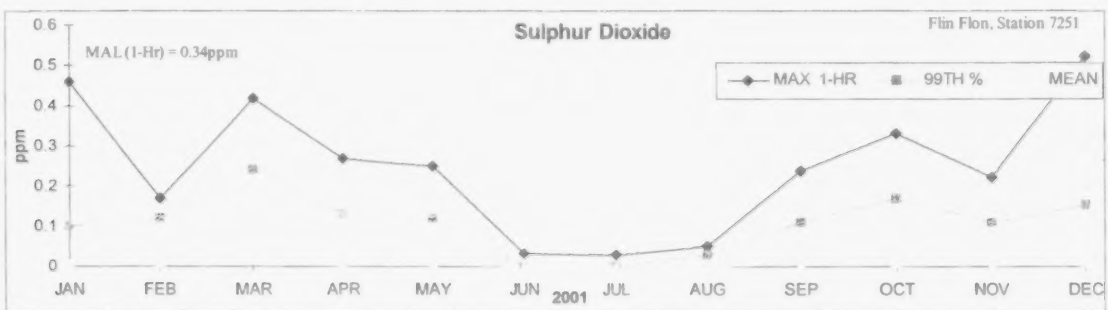

Figure 71 Monthly mean and 1-Hr maximum sulphur dioxide levels calculated and observed for the Flin Flon provincial monitoring site for 2001.

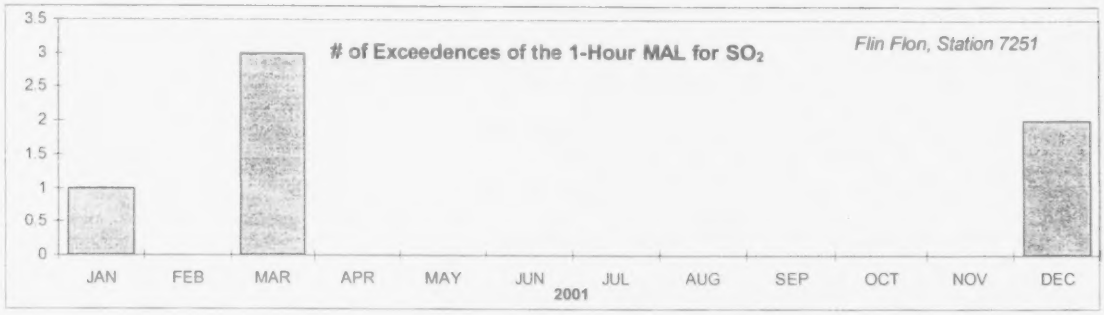

Figure 72. Number of exceedences of the 1-hour MAL for SO_2 for 2001 recorded at the provincial monitoring site.

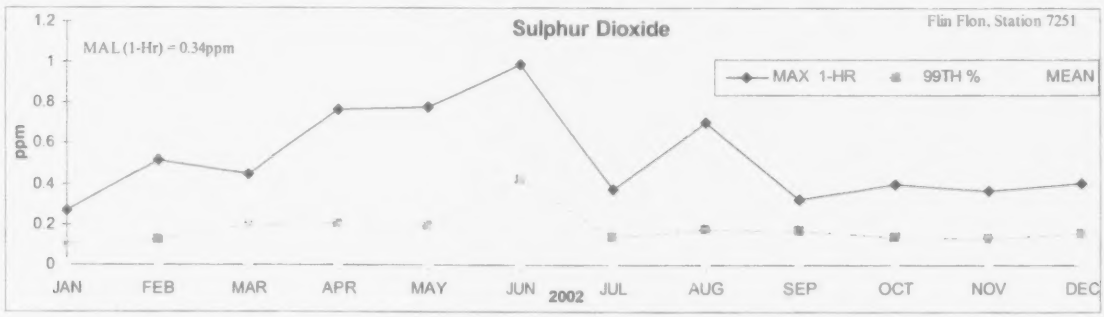

Figure 73. Monthly mean and 1-Hr maximum sulphur dioxide levels calculated and observed for the Flin Flon provincial monitoring site for 2002.

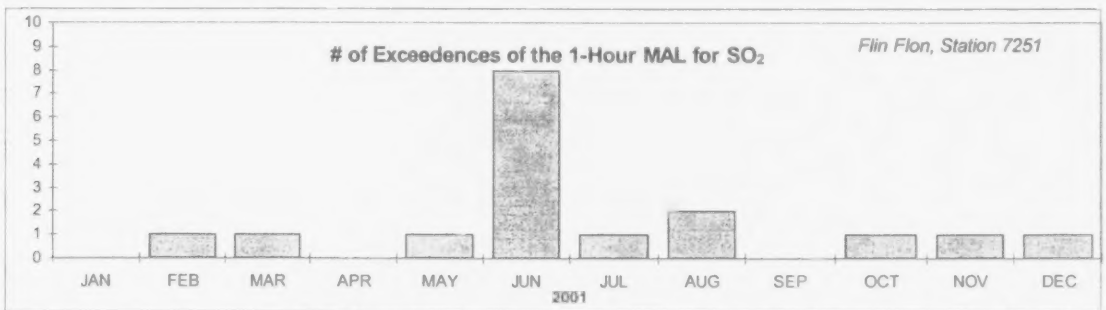

Figure 74. Number of exceedences of the 1-hour MAL for SO_2 for 2002 recorded at the provincial monitoring site.

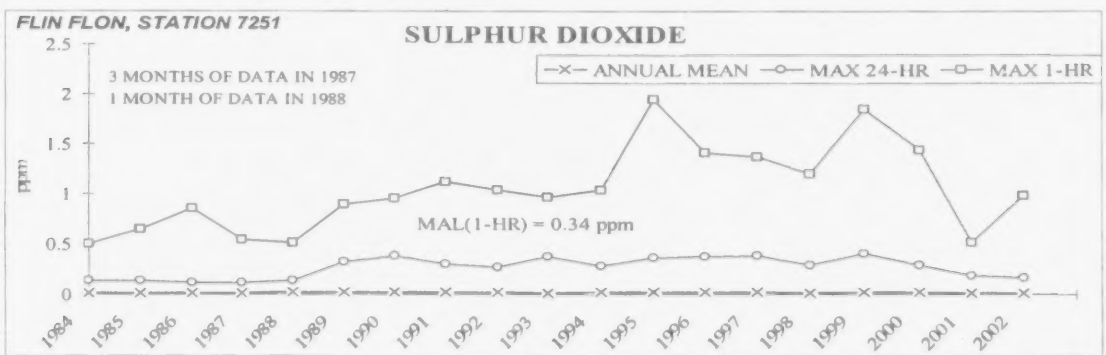

Figure 75. Annual mean, 24-Hr and 1-Hr maximum sulphur dioxide levels calculated and observed for the Flin Flon provincial monitoring site from 1984 through 2002.

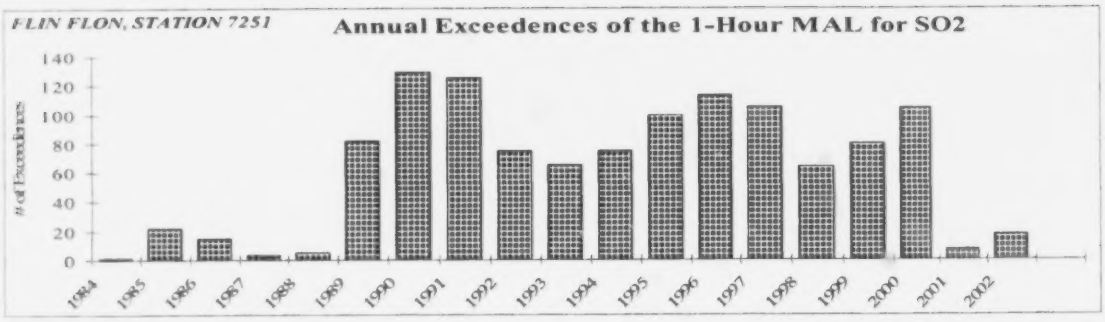

Figure 76. Number of exceedences of the 1-hour MAL for SO_2 recorded at the provincial monitoring site on an annual basis from 1984 through 2002. *Note: The location of monitoring in the uptown area changed in 1989.*

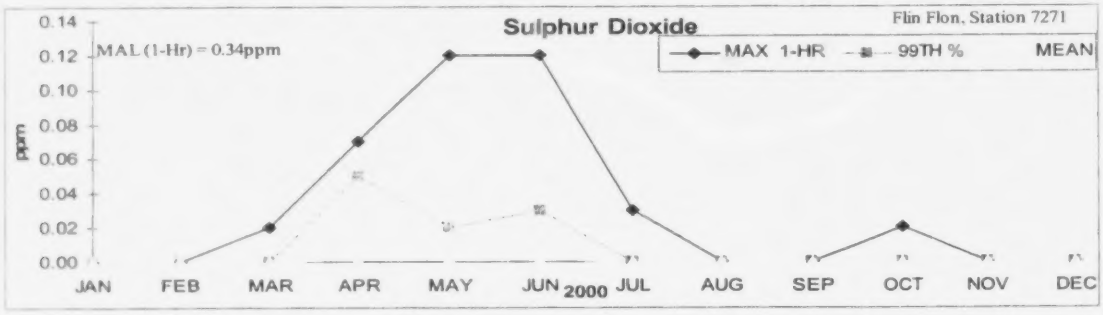

Figure 77. Monthly mean and 1-Hr maximum sulphur dioxide levels calculated and observed for the company monitoring site located at the Aqua Centre in Flin Flon, for 2000.

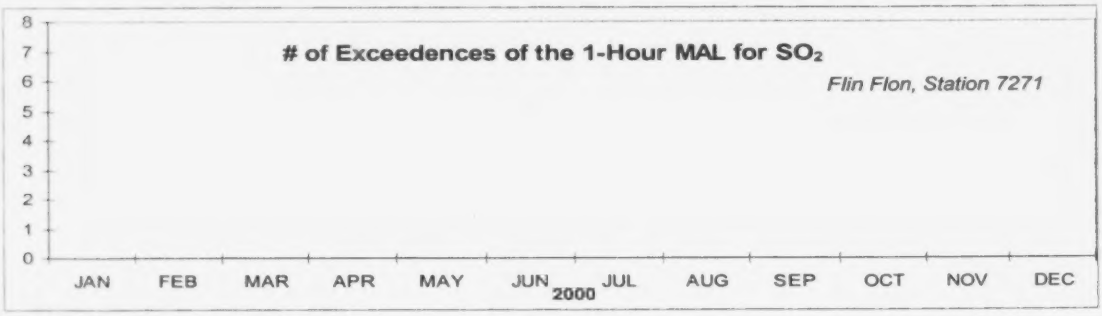

Figure 78. Number of exceedences of the 1-hour MAL for SO_2 for 2000 recorded at the company monitoring site located at the Aqua Centre in Flin Flon.

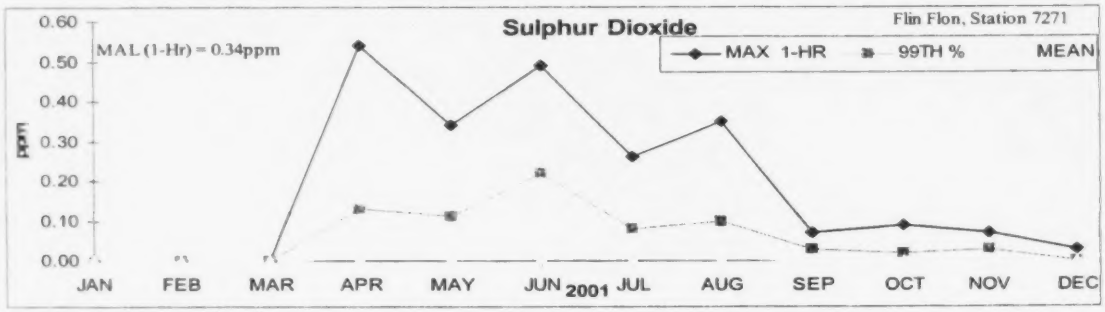

Figure 79. Monthly mean and 1-Hr maximum sulphur dioxide levels calculated and observed for the company monitoring site located at the Aqua Centre in Flin Flon, for 2001.

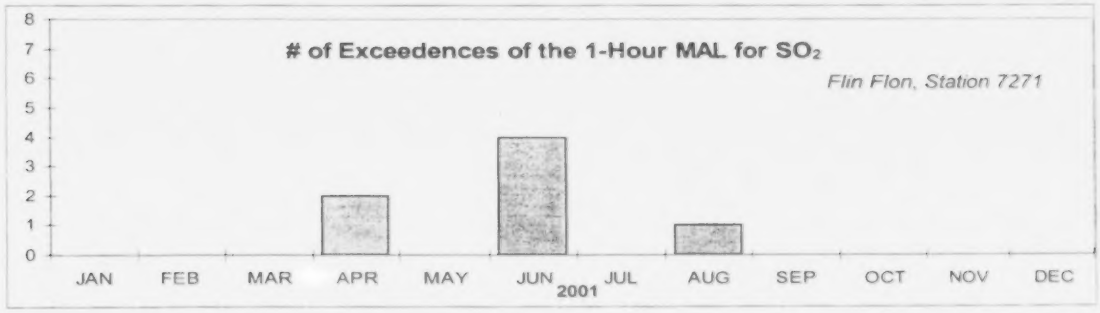

Figure 80. Number of exceedences of the 1-hour MAL for SO_2 for 2001 recorded at the company monitoring site located at the Aqua Centre in Flin Flon.

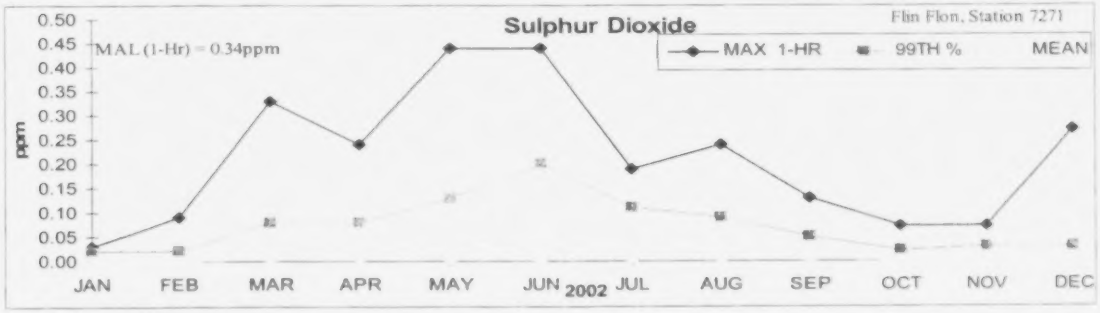

Figure 81. Monthly mean and 1-Hr maximum sulphur dioxide levels calculated and observed for the company monitoring site located at the Aqua Centre in Flin Flon, for 2002.

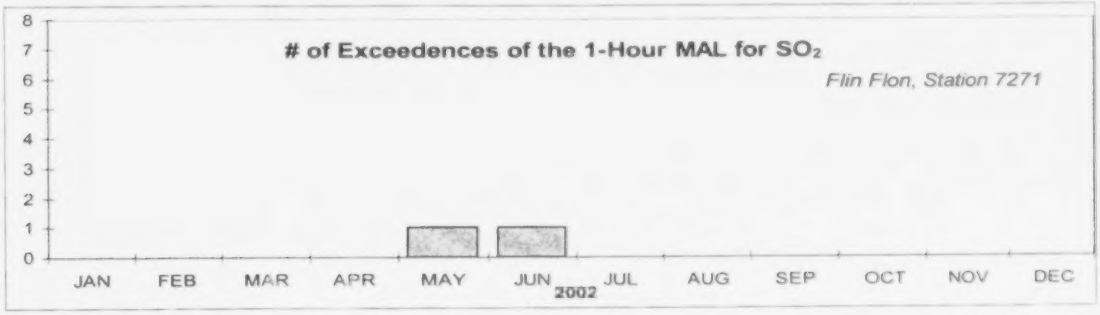

Figure 82. Number of exceedences of the 1-hour MAL for SO_2 for 2002 recorded at the company monitoring site located at the Aqua Centre in Flin Flon.

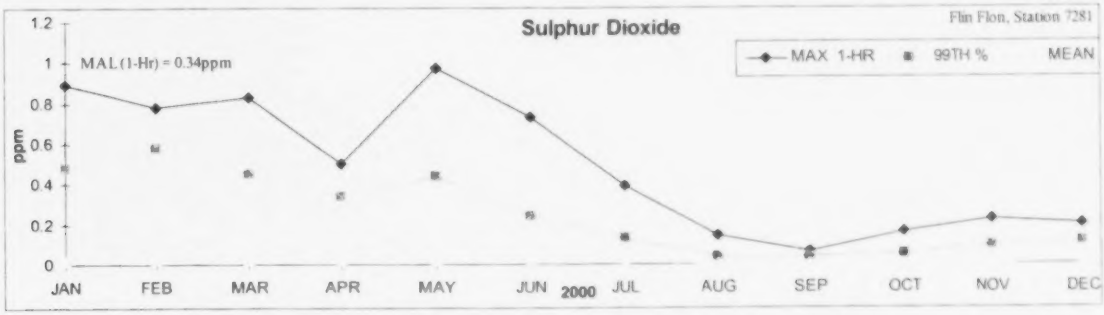

Figure 83. Monthly mean and 1-Hr maximum sulphur dioxide levels calculated and observed for the company monitoring site located at the HBM&S Staff House in Flin Flon, for 2000.

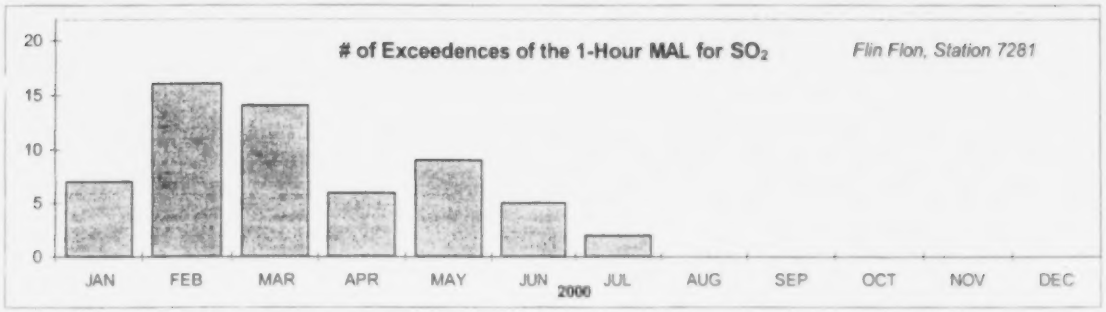

Figure 84. Number of exceedences of the 1-hour MAL for SO_2 for 2000 recorded at the company monitoring site located at the HBM&S Staff House in Flin Flon.

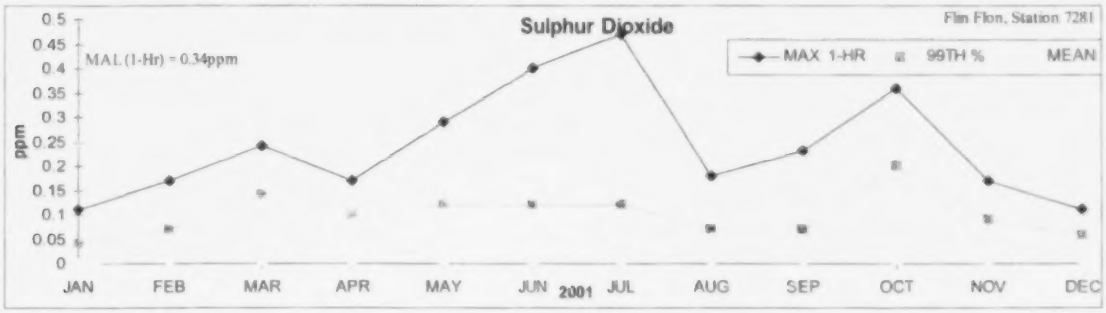

Figure 85. Monthly mean and 1-Hr maximum sulphur dioxide levels calculated and observed for the company monitoring site located at the HBM&S Staff House in Flin Flon, for 2001.

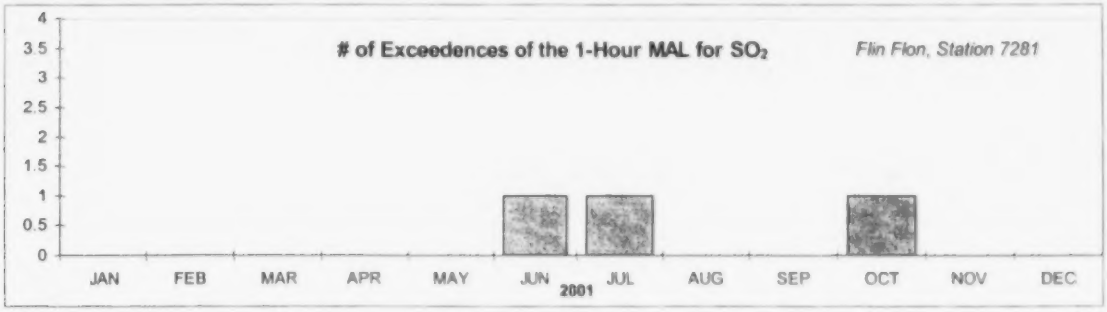

Figure 86. Number of exceedences of the 1-hour MAL for SO_2 for 2001 recorded at the company monitoring site located at the HBM&S Staff House in Flin Flon.

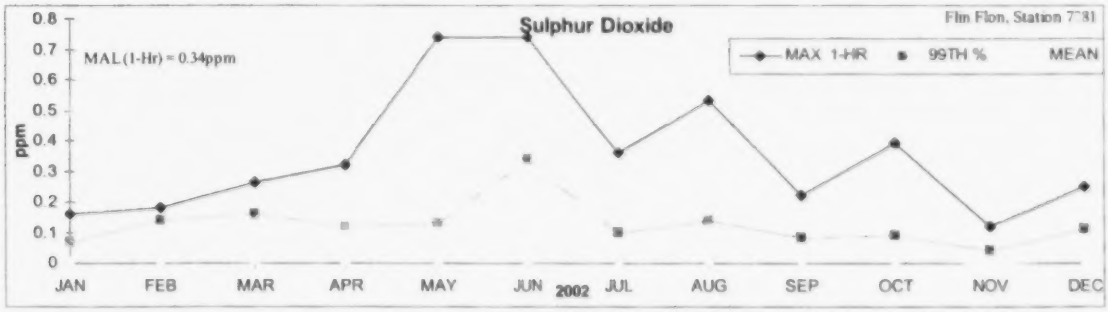

Figure 87. Monthly mean and 1-Hr maximum sulphur dioxide levels calculated and observed for the company monitoring site located at the HBM&S Staff House in Flin Flon, for 2002.

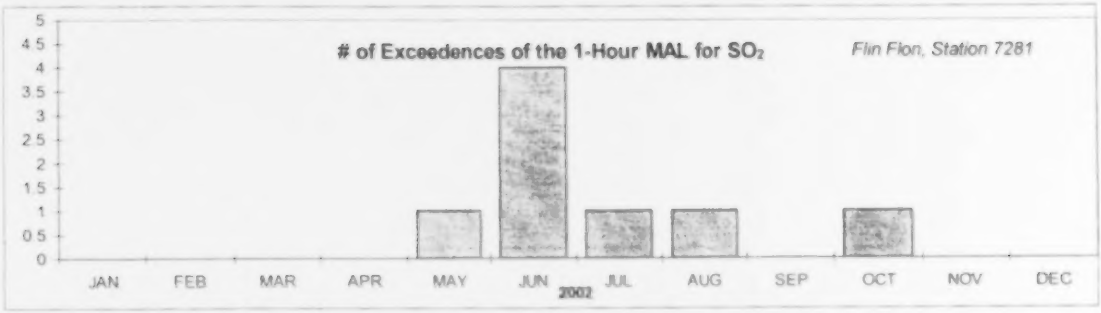

Figure 88. Number of exceedences of the 1-hour MAL for SO_2 for 2002 recorded at the company monitoring site located at the HBM&S Staff House in Flin Flon.

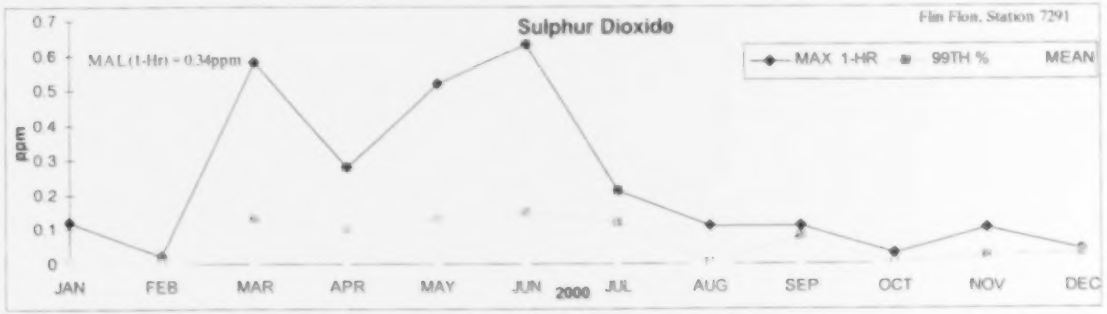

Figure 89. Monthly mean and 1-Hr maximum sulphur dioxide levels calculated and observed for the company monitoring site located at the Creighton (Sask.) City Fire Hall, for 2000.

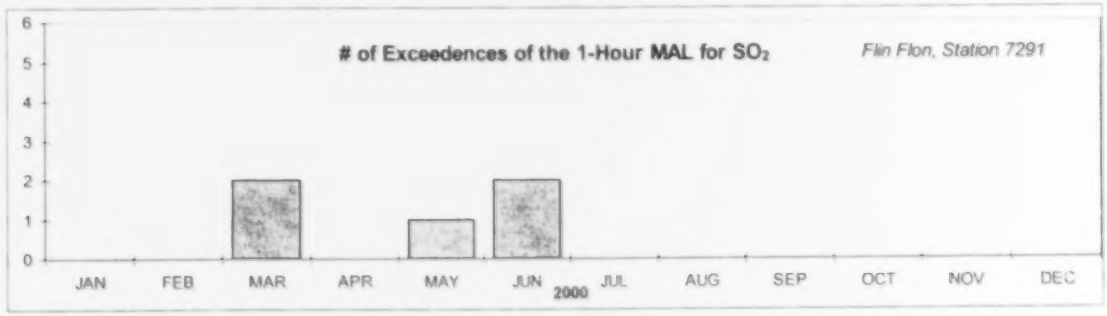

Figure 903. Number of exceedences of the 1-hour MAL for SO_2 for 2000 recorded at the company monitoring site located at the City Fire Hall in Creighton, Sask.

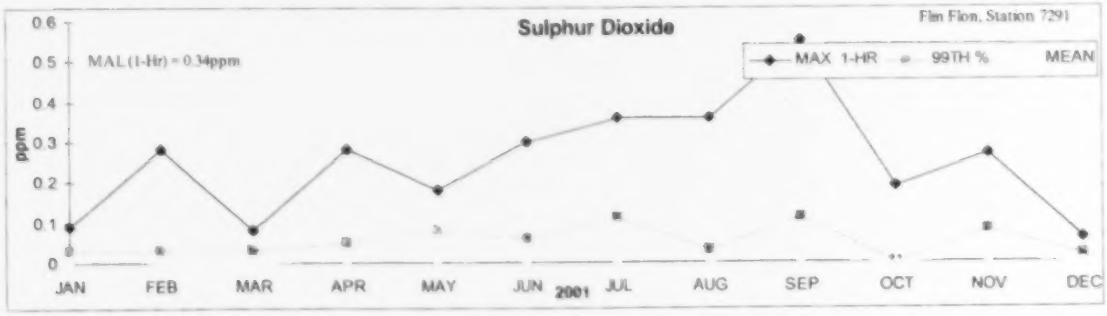

Figure 91. Monthly mean and 1-Hr maximum sulphur dioxide levels calculated and observed for the company monitoring site located at the Creighton (Sask.) City Fire Hall, for 2001.

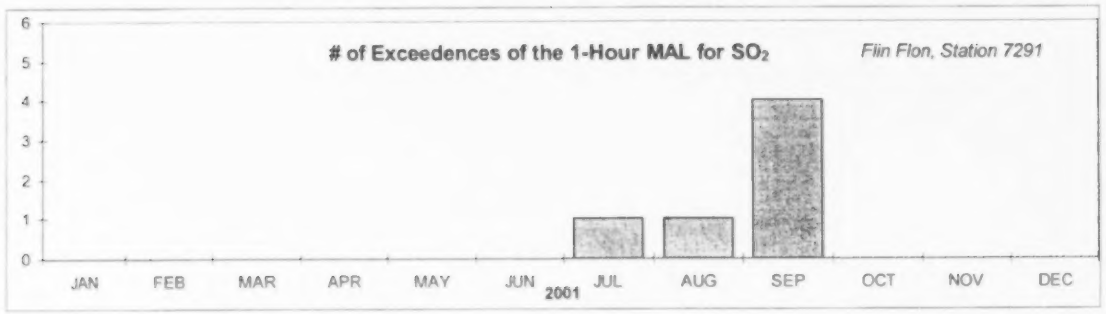

Figure 92. Number of exceedences of the 1-hour MAL for SO_2 for 2001 recorded at the company monitoring site located at the City Fire Hall in Creighton, Sask.

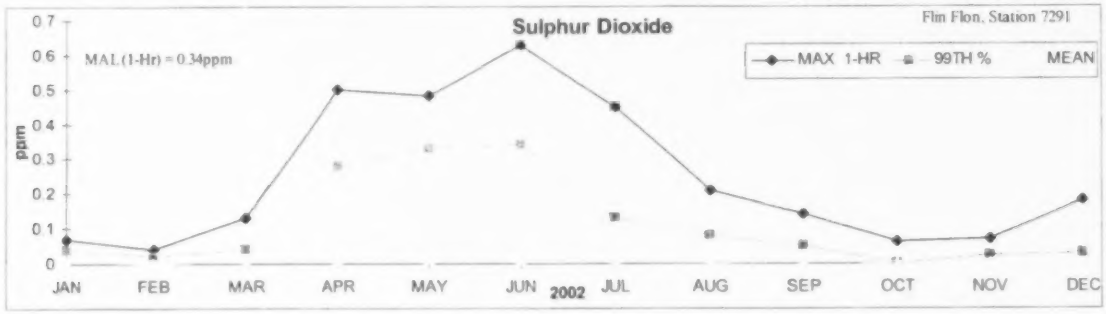

Figure 93. Monthly mean and 1-Hr maximum sulphur dioxide levels calculated and observed for the company monitoring site located at the Creighton (Sask.) City Fire Hall, for 2002.

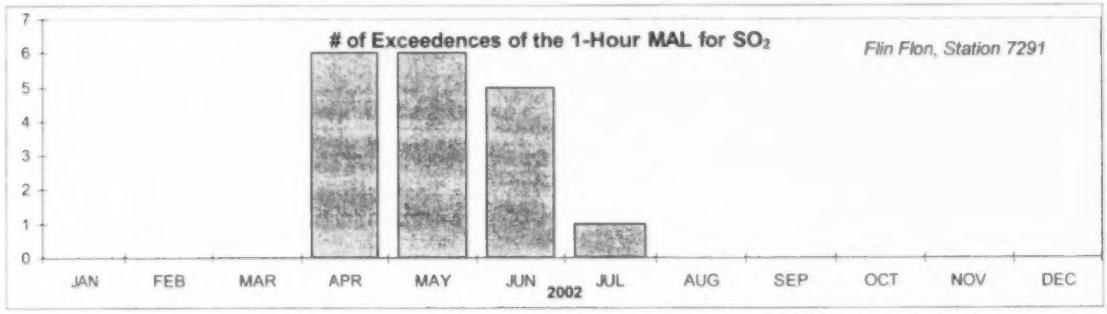

Figure 94. Number of exceedences of the 1-hour MAL for SO_2 for 2002 recorded at the company monitoring site located at the City Fire Hall in Creighton, Sask.

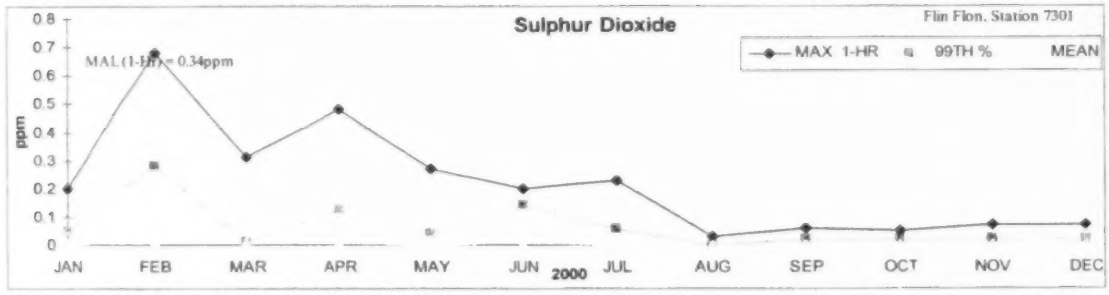

Figure 95. Monthly mean and 1-Hr maximum sulphur dioxide levels calculated and observed for the company monitoring site located at Hapnot Collegiate in Flin Flon, for 2000.

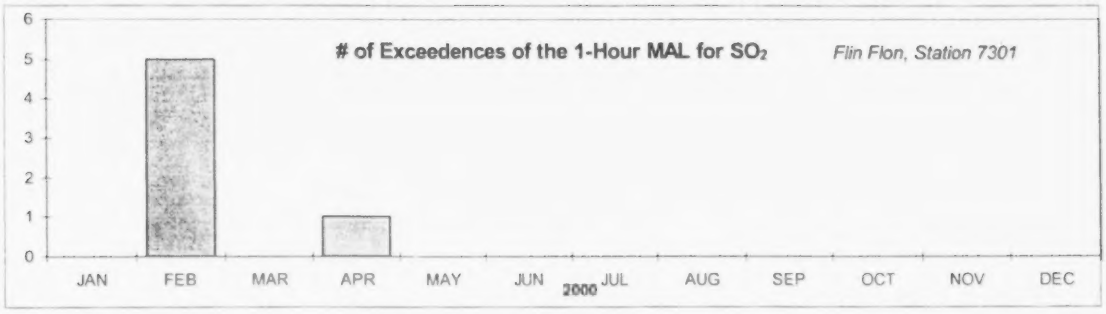

Figure 96. Number of exceedences of the 1-hour MAL for SO_2 for 2000 recorded at the company monitoring site located at Hapnot Collegiate in Flin Flon.

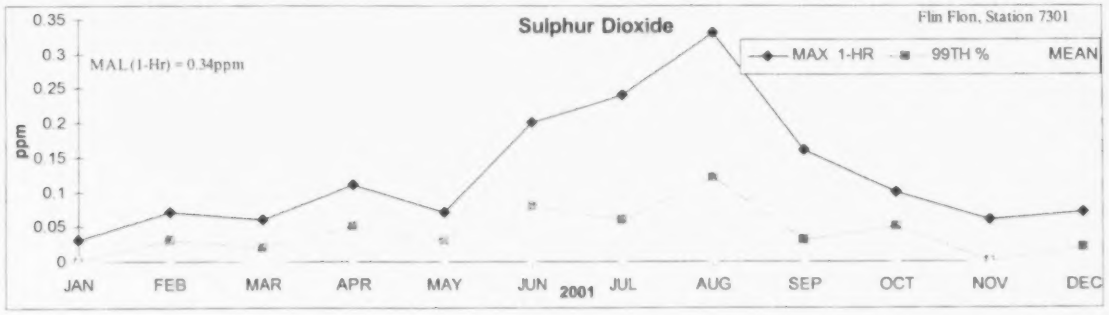

Figure 97. Monthly mean and 1-Hr maximum sulphur dioxide levels calculated and observed for the company monitoring site located at Hapnot Collegiate in Flin Flon, for 2001.

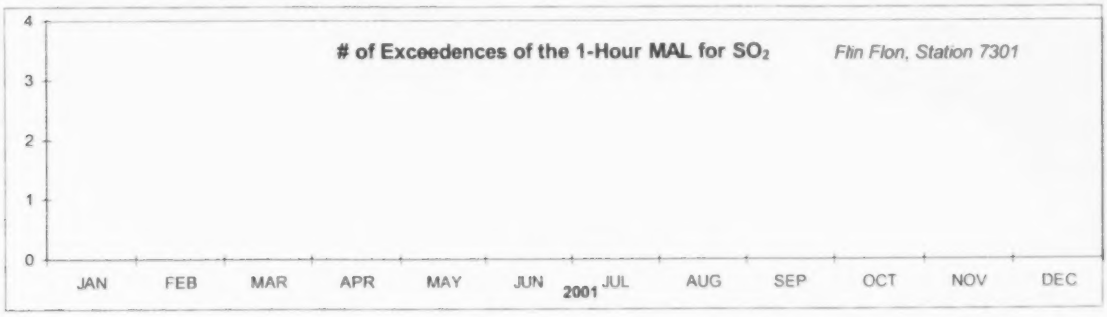

Figure 98. Number of exceedences of the 1-hour MAL for SO_2 for 2001 recorded at the company monitoring site located at Hapnot Collegiate in Flin Flon.

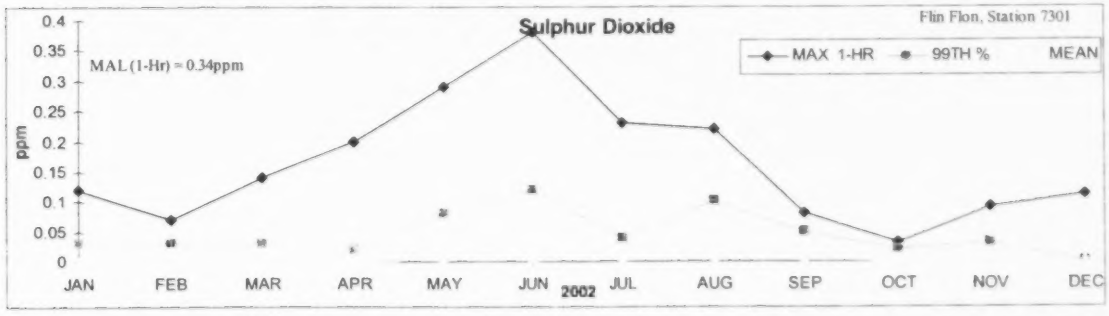

Figure 99. Monthly mean and 1-Hr maximum sulphur dioxide levels calculated and observed for the company monitoring site located at Hapnot Collegiate in Flin Flon, for 2002.

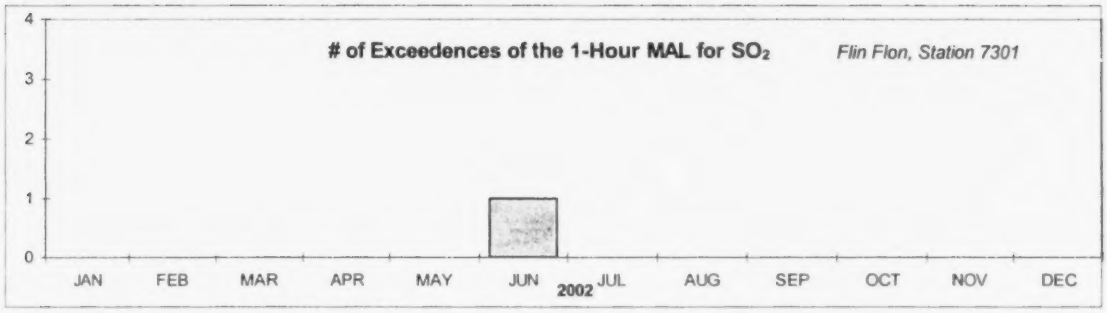

Figure 100. Number of exceedences of the 1-hour MAL for SO_2 for 2002 recorded at the company monitoring site located at Hapnot Collegiate in Flin Flon.

TSP, PM_{10}, Pb, $SO_4^=$, NO_3^-, Arsenic (As), Cadmium (Cd), Copper (Cu), and Zinc (Zn)

TSP and PM_{10}, $SO_4^=$, NO_3^-, and the heavy metal (Lead (Pb), Arsenic (As), Cadmium (Cd), Copper (Cu), and Zinc (Zn)) content of these particles were also monitored in 2000, 2001 and 2002 by the Province at one location and the company at two other locations within Flin Flon. Annual summaries are presented in Tables 3a, 5a and 7a for the PM_{10} monitoring and in Tables 3c, 5c and 7c for the TSP monitoring. Monthly summaries are shown in Figures 101 to 112 for TSP for the Provincial monitoring site and the three company-operated monitoring sites in the Flin Flon area. Levels of the sulphate, nitrate and the heavy metals in the PM_{10} samples were generally lower than in the TSP samples.

Ten samples in 2000, thirteen samples in 2001 and nine samples in 2002 exceeded the 24-hour MAL for TSP at the provincial monitoring site. For 2000, there were two samples at the Creighton School site and one at the Sewage Plant site that exceeded the 24-hr MAL for TSP. For 2001 there was a total of six exceedences at the three sites, two at Creighton School, three at Ruth Betts and one at the Sewage Plant site. There were no exceedences observed at Ruth Betts or the Sewage Plant in 2002.

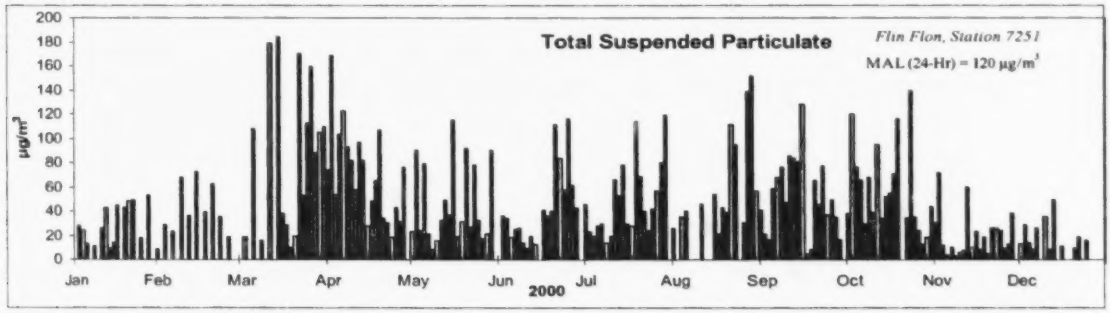

Figure 101. Volume-weighted 24-Hr TSP levels calculated and observed for the Flin Flon downtown monitoring site for 2000.

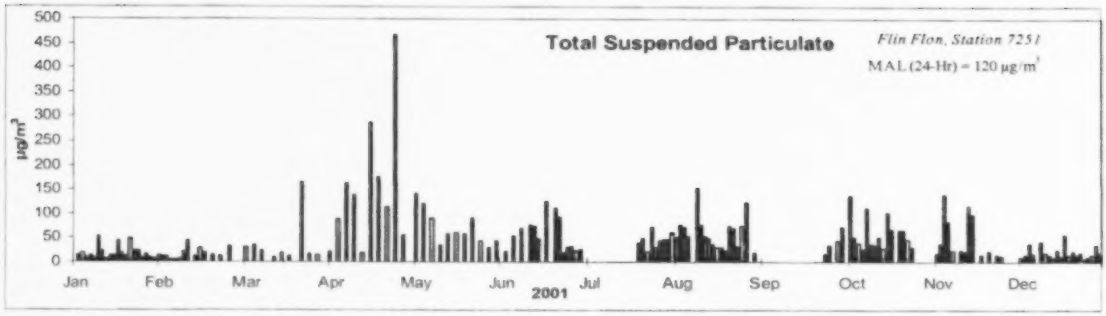

Figure 102. Volume-weighted 24-Hr TSP levels calculated and observed for the Flin Flon downtown monitoring site for 2001.

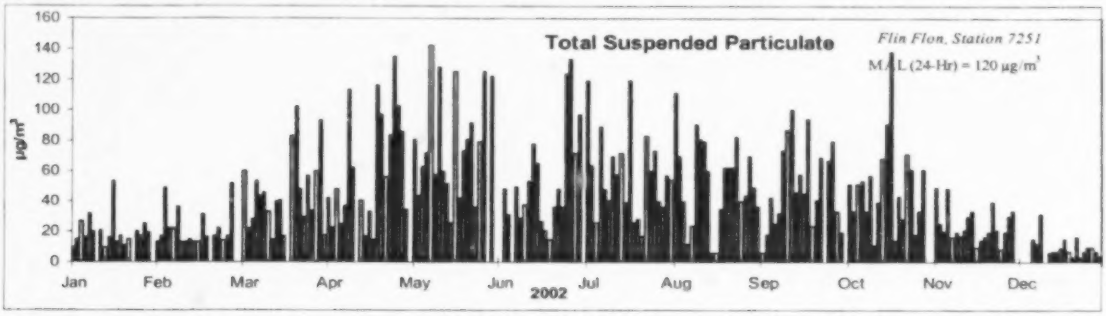

Figure 103. Volume-weighted 24-Hr TSP levels calculated and observed for the Flin Flon downtown monitoring site for 2002.

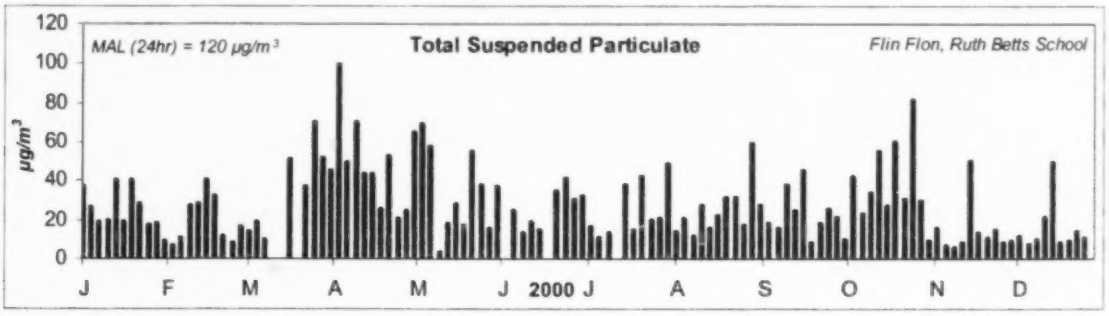

Figure 104. Volume-weighted 24-Hr TSP levels calculated and observed for the company-operated monitoring site located at Ruth Betts School in Flin Flon for 2000.

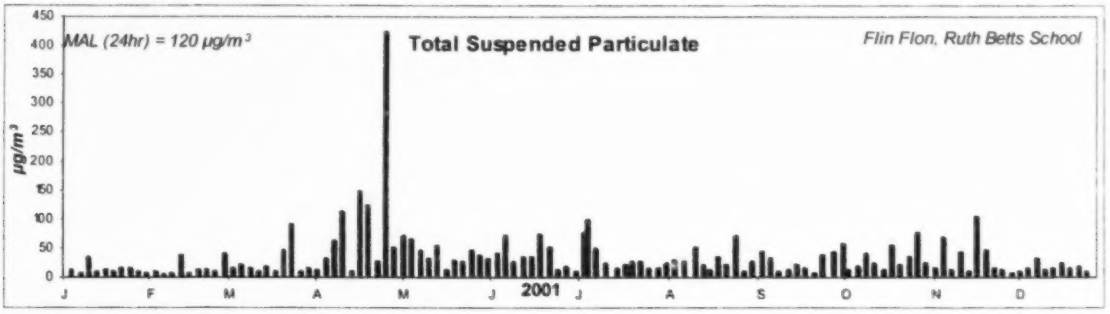

Figure 105. Volume-weighted 24-Hr TSP levels calculated and observed for the company-operated monitoring site located at Ruth Betts School in Flin Flon for 2001.

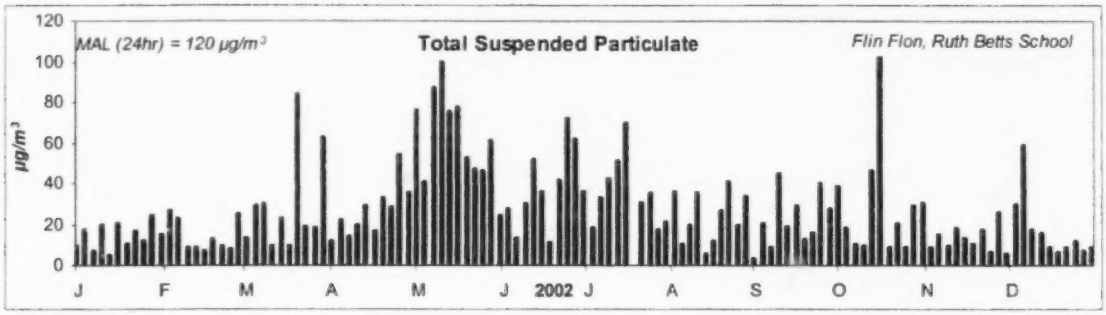

Figure 106. Volume-weighted 24-Hr TSP levels calculated and observed for the company-operated monitoring site located at Ruth Betts School in Flin Flon for 2002.

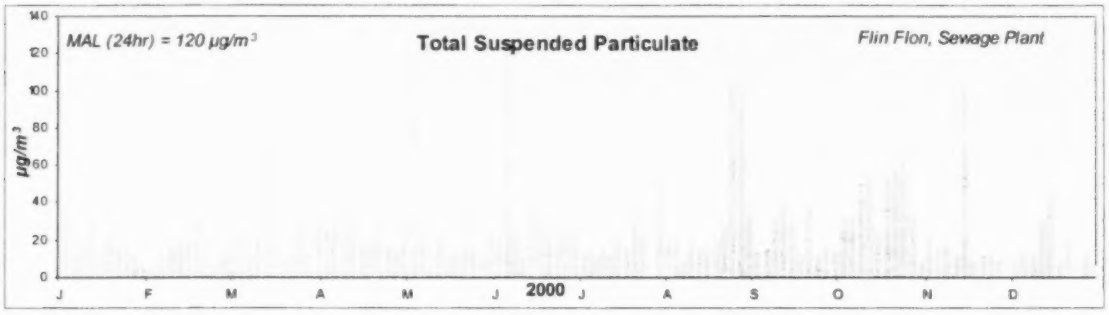

Figure 107. Volume-weighted 24-Hr TSP levels calculated and observed for the company-operated monitoring site located at the Sewage Plant in Flin Flon for 2000.

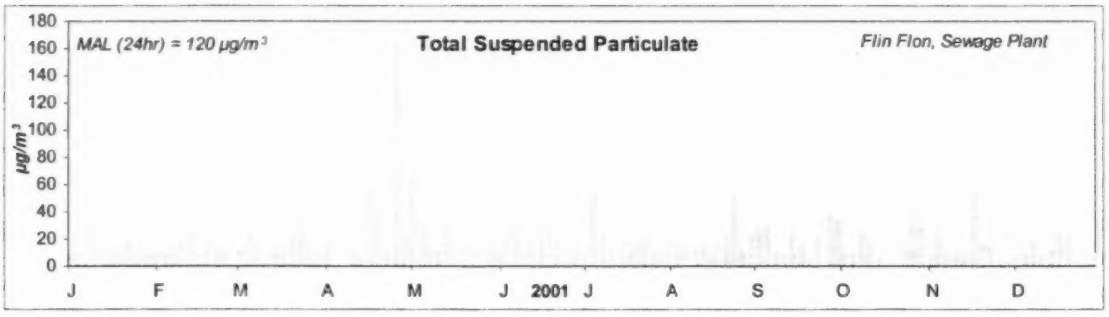

Figure 108. Volume-weighted 24-Hr TSP levels calculated and observed for the company-operated monitoring site located at the Sewage Plant in Flin Flon for 2001.

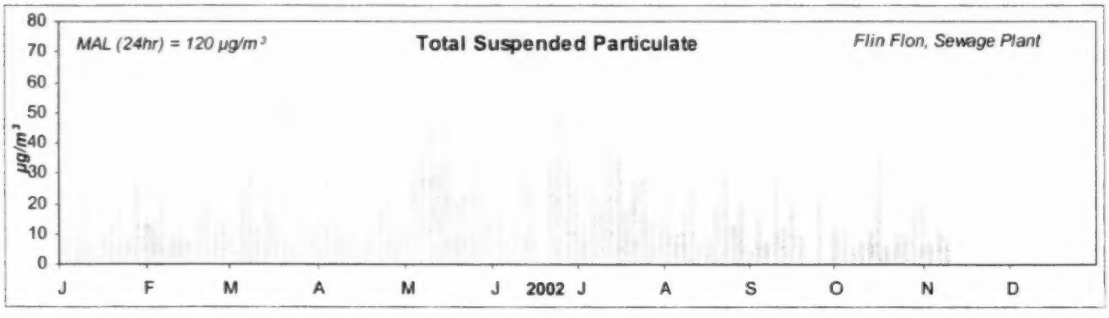

Figure 109. Volume-weighted 24-Hr TSP levels calculated and observed for the company-operated monitoring site located at the Sewage Plant in Flin Flon for 2002.

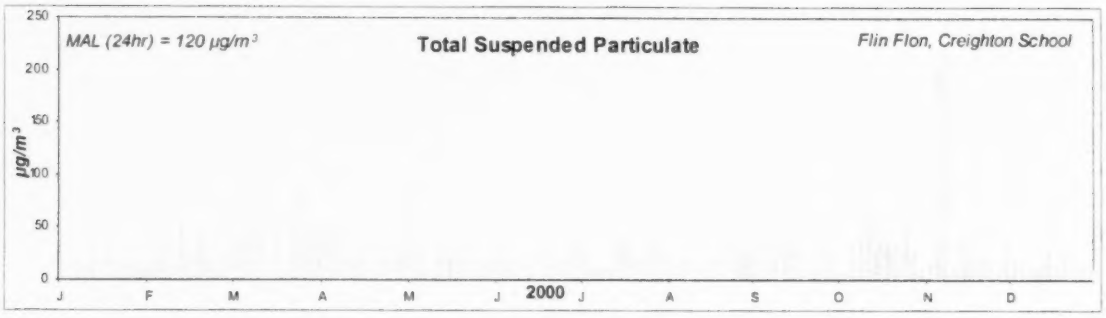

Figure 110. Volume-weighted 24-Hr TSP levels calculated and observed for the company-operated monitoring site located at the School in Creighton, Saskatchewan for 2000.

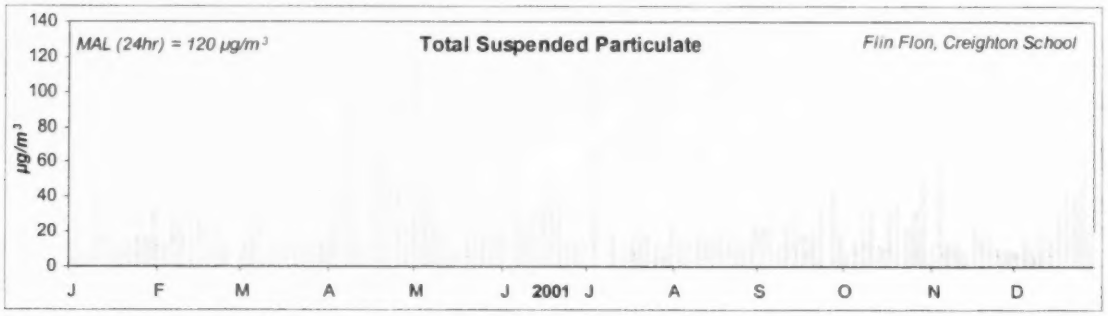

Figure 111. Volume-weighted 24-Hr TSP levels calculated and observed for the company-operated monitoring site located at the School in Creighton, Saskatchewan for 2001.

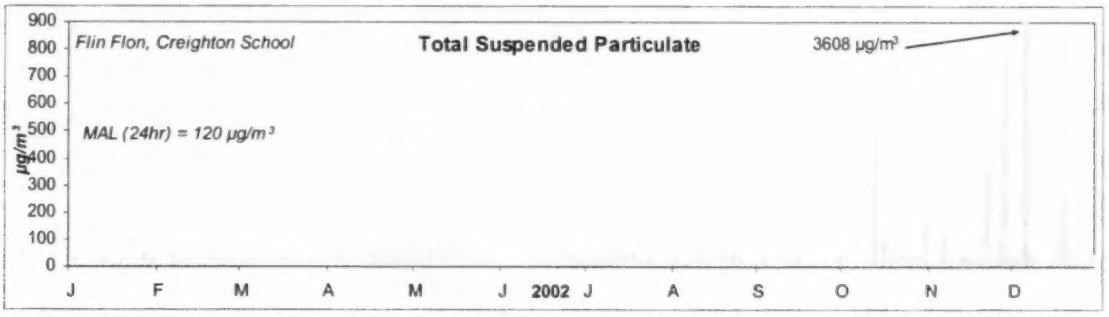

Figure 112. Volume-weighted 24-Hr TSP levels calculated and observed for the company-operated monitoring site located at the School in Creighton, Saskatchewan for 2002.

Creighton on the other hand experienced eight exceedences, beginning on October 14th, 2002, where a level of 478 µg/m³ was observed. This was followed by three exceedences in November on the 1st, 23rd and 29th of 167 µg/m³, 347 µg/m³, and 767 µg/m³ respectively. December saw four more events beginning on the 6th where a level of 3601 µg/m³ was recorded followed by a level of 508 µg/m³ on the 7th. The 19th and 20th of December saw levels of 282 µg/m³ and 188 µg/m³, respectively. The high dust levels observed during the latter quarter of 2002 was attributed to the dry fall months and lack of snow

cover. This resulted in a major dusting event on December 6th, 2002, where a strong north wind whipped up fine dust from the tailings pond and carried it into Creighton. Downtown Flin Flon where two Provincial monitors are located, was at the outer edge of this dust cloud. As a result of this event, the frequency of monitoring by the company in the Creighton area was increased.

One sample, from the Provincial site, exceeded the Provincial Guideline of 5.0 $\mu g/m^3$ for Pb in 2000. In 2001 and 2002, none of the samples collected from the Provincially operated sited or the company operated sites exceeded the Provincial guideline for lead. Discussion of the heavy metals As, Cd, Cu, and Zn (Tables 4a and 4c, 6a and 6c, 8a and 8c) will not be included in this report. For the afore-mentioned heavy metals, where there is a listing for exceedences of the 24-hr MAL, the exceedences were based on the Ontario Guidelines for these heavy metals. Other provincial reports specifically relating to heavy metals in Flin Flon are available (Bezak, D. 1991 and Manitoba Environment 1989). Quarterly reports detailing particulate matter (PM_{10}) levels and selected heavy metals levels in dust are produced by Manitoba Conservation and distributed to interested groups and individuals in the Flin Flon area.

D. THOMPSON AIR QUALITY

SO_2 monitoring in Thompson was conducted only by the local nickel smelting company, which is located south of the town, and the yearly results are shown in Tables 2, 4 and 6. Reported SO_2 emissions from this complex were 215 kilotonnes in 2000, 217 kilotonnes in 2001 and 196 kilotonnes in 2002. There were 14 exceedences of the Provincial 1-hour MAL of 0.34 ppm for SO_2 in 2000, and none in each of 2001 and 2002. Yearly trends are shown in Figures 113 and 114.

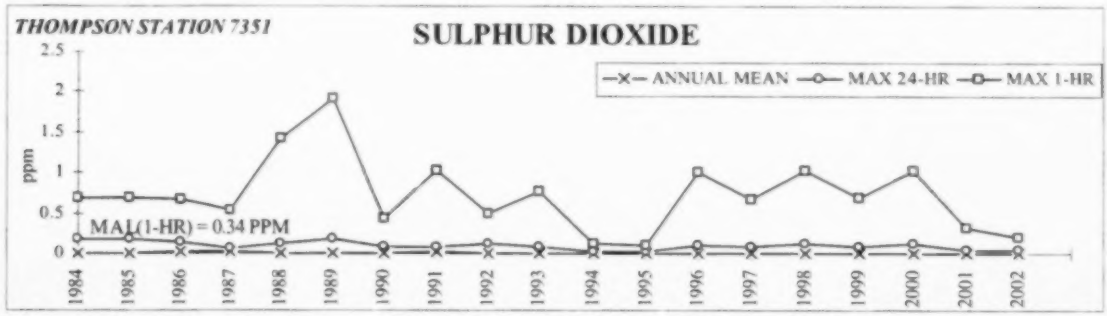

Figure 113. Annual mean, 24-Hr and 1-Hr maximum sulphur dioxide levels calculated and observed for the company operated Thompson monitoring site from 1984 through 2002.

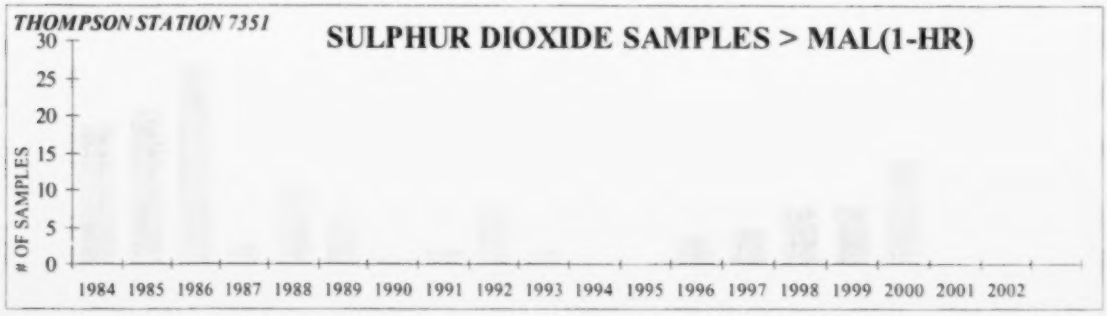

Figure 114. Number of exceedences of the 1-hour MAL for SO_2 annual recorded at the company operated monitoring site in Thompson from 1984 through 2002.

E. TILSTON AIR QUALITY

SO_2 and H_2S monitoring in the Tilston area was conducted by Manitoba Conservation. Results of this monitoring program have been published (Manitoba Conservation 2002a and 2002b) elsewhere.

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